

A review of *Micropterix* Hübner, 1825 from northern and central Europe (Micropterigidae)

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Abstract. All known species of the Palaearctic genus *Micropterix* Hübner, 1825 (Micropterigidae) from northern, north-western, central and north-eastern Europe including the Alps are reviewed. The purpose of this review is to permit reliable identification of the genus in this region. Adults, male and female genitalia are illustrated for eighteen species. For these, taxonomy, adult life history (preferred biotopes, phenology and pollination records) and variability is detailed. Distribution is summarized for each species. Treated species are fully diagnosed and also compared with extralimital taxa. The presently known species diversity of *Micropterix* is assessed and a brief synopsis of diagnostic characters for the genus is given in the context of what is known for the family worldwide. A checklist is provided and a key is presented based on adult wing pattern and characters of the male and female genitalia. Advice on genitalic preparation and information about suitable collection sites is also provided.

Introduction

The genus *Micropterix* Hübner, 1825 is distributed in the temperate and subtropical zones of Eurasia, as well as of Northern Africa (Kristensen 1984a). Up to now, 83 species are known (72 have been described), taking into account probable synonymy, of which 49 occur in Europe, 16 additional species in Asia (very few of which reach the eastern Palaearctic), and about 17 additional in northern Africa. This makes *Micropterix* by far the most species rich genus of Micropterigidae, a family numbering about 132 described and about 93 undescribed species up to end of 2006 (Kristensen 1999; Hashimoto 2006; Gibbs in litt.). Most of the described species occur in the Mediterranean region, and several undescribed species are to be expected in the mountains of Asia.

It is the purpose of this paper to review eighteen species of the Palaearctic genus *Micropterix*. We treat all species known from northern, north-western, central and north-eastern Europe, including Fennoscandia, Great Britain and Ireland, France (including the northern slopes of the Pyrenees), the entire Alps, Hungary, Romania, Slovakia, Poland, Belarus and the Baltic States (Fig. 122). All species are figured in colour, and their genitalia are illustrated. Our focus in this paper is on the aspects of the species most useful for identification, namely wing colour patterns and abdominal morphology, for which we present a key. We also summarise what is known of adult life history and emphasise how little is known of the evolutionary relationships even of European species. We present for now a largely phenetic arrangement of species. In this paper we build on the previous important identification treatments by Heath (1987), Kozlov (1989, 1990a, b) and Whitebread (1992).

Material and methods

For many years the authors have collected specimens of *Micropterix* throughout the western Palaearctic region. These specimens form the basis of the presented study. Furthermore many other specimens, including type specimens from the following museum and private collections have been investigated:

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| BMNH | British Museum of Natural History, London |
| CZ | Collection Christof Zeller |
| HNSA | Museum Haus der Natur, Salzburg |
| IEUP | Istituto di Entomologia, Università degli Studi, Pavia, Italy |
| LSUK | Linnean Society, London |
| MK | Collection Michael Kurz |
| MNHN | Museum National Histoire Naturel, Paris |
| MSNM | Museo Civico di Storia Naturale, Milano |
| MSNV | Museo Civico di Storia Naturale, Verona |
| NHMK | Landesmuseum für Kärnten, Klagenfurt |
| NHRS | Naturhistoriska Riksmuseet, Stockholm |
| NMW | Naturhistorisches Museum, Wien |
| OLML | Oberösterreichisches Landesmuseum, Biologiezentrum, Linz |
| SMNK | Staatliches Museum für Naturkunde, Karlsruhe |
| TLMF | Tiroler Landesmuseum Ferdinandeum, Innsbruck |
| USNM | Smithsonian National Museum of Natural History, Washington |
| ZMHB | Museum für Naturkunde, Humboldt-Universität zu Berlin |
| ZMUC | Zoological Museum, Copenhagen |
| ZSM | Zoologische Sammlung des Bayerischen Staates, München |

Collection sites. Best collection sites are boundaries of shrub vegetation and woodland, where the adults gather on flowering vegetation often very locally, but often also in great abundance. The specimens fly only short distances, but can frequently be found crawling around pollinating many different blossoms. Some species prefer herbaceous plants, others shrubs or trees. In the southern latitude or lower elevation areas *Micropterix* were more usually found in shaded areas than areas exposed to full sunshine; in more northern latitudes, they often occur in open sunny areas. At a given locality, adults aggregate usually on a limited range or even only a single plant species. At higher elevations some species can often be found around elfin woodland, feeding on the pollen of *Pinus mugo* Turra. Ecologically more specialized species inhabit marshes, dwarf vegetation, open grassland or alpine meadows. In the Mediterranean, specimens often rest on the underside of leaves or in shady places during the hottest hours of the day, being active mainly in the morning and in the evening. In woodland, specimens may be active throughout daytime.

The adults are attracted to flowers of the following gymnosperm and angiosperm (monocot and dicot) plant families and genera or species (Adler et al. 1994; Kozlov 2006; Pankhurst 1999; Schwartz-Tzachor 2004; Zeller-Lukashort, Kurz & Kurz 2006; Helmut Deutsch, Markus Fluri, Peter Huemer, Utsugi Jinbo, all pers. comm.; this work): Pinaceae (*Pinus mugo* Turra), Ranunculaceae (*Caltha palustris* L., *Actaea spicata* L., *Ranunculus* spp.), Caryophyllaceae (*Lychnis flos-cuculi* L., *Stellaria holostea* L.), Fagaceae (*Fagus sylvatica* L. (pollen on leaves, not flowers), *Quercus* spp.), Urticaceae

(*Urtica dioica* L.), Brassicaceae (*Cardamine pratensis* L.), Sapindaceae (*Acer pseudo-platanus* L.), Rosaceae (*Aruncus dioicus* (Walter) Fernald, *Crataegus* sp., *Filipendula ulmaria* (L.) Maxim., *Rosa pendulina* L., *Rosa canina* L. agg), Fabaceae (*Spartium junceum* L., *Vicia* sp.), Euphorbiaceae (*Mercurialis perennis* L.), Apiaceae (*Heracleum* sp.), Cistaceae (*Helianthemum* sp., *Cistus salvifolius* L.), Ericaceae (*Rhododendron ferrugineum* L., *Vaccinium* sp.), Pyrolaceae (*Pyrola* sp.), Primulaceae (*Cyclamen persicum* Mill.), Rubiaceae (*Galium* sp.), Scrophulariaceae (*Veronica chamaedrys* L.), Plantaginaceae (*Plantago media* L.), Oleaceae (*Fraxinus ornus* L., *Olea europaea* L., *Syringa vulgaris* L.), Caprifoliaceae (*Sambucus nigra* L., *Lonicera xylosteum* L.), Liliaceae (*Paris quadrifolia* L.), Orchidaceae (*Dactylorhiza romana* (Sebast & Mauri) Soó), Cyperaceae (*Carex* spp.) and Poaceae.

External characters used for identification. Forewing markings and the colour of the scales of the head are the external characters used for the identification of the *Micropterix* species dealt within this paper. The colouration of the wings is solely due to the physical properties of the wing scales (which are of the ‘fused’ type and on the upper surface as in other lower grade Lepidoptera). Wing pattern is dominated by a combination of metallic golden, silvery and purplish elements. The basic marking scheme on the forewing seems to be a purplish ground colour with three transverse golden fasciae. This basic scheme is modified in many ways, such as by additional spots and fasciae, or by shifting the purplish ground colour to a golden one and the colour of the fasciae varying to a whitish or silvery one. Although of great importance for identification, forewing markings do vary to a significant degree. This variation seems to be not only genetically determined, but may be influenced by local habitat conditions, as discussed below under Life history, and on a geographic basis according to metapopulation structuring (Kozlov 1995). We include several instances here of local, geographically distinct colour morphs (see e.g. *Micropterix paykullella* (Fabricius, 1794), *Micropterix aruncella* (Scopoli, 1763)). Schematic wing drawings used in the identification key are encoded as given in Fig. 1.

| | |
|--|--|
|  | brownish golden - purple - bluish violet |
|  | reddish golden - coppery |
|  | bronzy golden - greenish golden |
|  | golden |
|  | whitish golden - silvery |

Fig. 1. Code of schematic wing drawings.

Anatomical characters used for identification. Several anatomical details, presenting valuable characters in some other lepidopterous families, like wing venation or number and size of spurs on the legs, are not useful for species identification in the genus *Micropterix*. Male genitalia are very characteristic in this genus and always present sufficient details for a reliable specific identification. Female genitalia, although less useful, sometimes yield useful exoskeletal characters on segments IX and X, and to some extent from the shape and length of the receptaculum seminis. Nevertheless, in

some cases, the geographical distribution has also to be considered, since many similar species are allopatric or endemic to a relatively small area. The main features of male and female abdominal characters are explained in Figs 2 and 3.

Preparation techniques (genitalia preparation). The whole of the abdomen is removed and then transferred to a 10%-solution of caustic potash. By gentle shaking, the solution is heated until the abdomen becomes transparent and the 'soft tissues' have been completely dissolved. After rinsing the abdomen with water, it can be transferred to a drop of a 7:3 mixture of water and glycerol on a micro slide. The preparation should be as clean and devoid of scales as possible when inspecting it under 20–30 fold magnification. Most drawings and many photos of the female genitalia have been made in this stage of preparation, since the receptaculum seminis may be recognized very well now. Details of sclerotized parts have been added to the drawings using permanent preparations.

For determination purposes only, it is normally not necessary to remove the sclerotized parts or the phallus from the male genitalia. Also it is not necessary to stain the preparation, since all diagnostically important characters are strongly sclerotized. Therefore the preparation can be transferred to 96% ethanol for at least 15 minutes and afterwards mounted in Euparal in lateral position. For this purpose, the genitalia are first fixed in a drop of Euparal overnight before the cover slip is brought into position with a second drop of Euparal. With this technique, squeezing the genitalia can be avoided best. For taxonomical studies it may be necessary to remove the sclerotized parts and the phallus, to choose another position than the lateral one or to squeeze the genitalia (especially when investigating the spinoid (thickened) setae of the accessory claspers).

When preparing female genitalia, it is important to know that the inner structures of the abdomen are not sclerotized at all. Removing the pregenital exoskeleton and staining the preparation is therefore not advisable, because dehydration during the process strongly deforms the receptaculum seminis. Furthermore sternum IX may be damaged, which is important for some species identifications. After rinsing the preparation with water, the following procedure can therefore be used for the mounting of the female genitalia. Firstly, the last two segments of the abdomen, forming a short, retractable ovipositor, are expanded carefully. These segments must not be damaged. A micro-pipette, that has been drawn above a flame to a very fine tip is connected to a rubber tube with a mouth-part and filled with a dispersion of chlorazol black in water. Then the tip of the pipette is inserted into the abdomen up to segment VI or VII, beginning at the proximal end. A tiny amount of the stain suspension is now injected by gentle pressure. In this way the receptaculum seminis may be stained blue without opening the exoskeleton. This also helps to avoid distortion of the membranous receptaculum seminis when dehydrating the preparation with 96% ethanol. Finally the preparation is transferred to Euparal and mounted in the usual way. A lateral position fits the natural flattening of the abdomen, although for investigation of sternite IX a dorso-ventral mounting is to be preferred.

Data archives. The data of all investigated specimens have been archived in a database, which is accessible via internet: <http://www.nkis.info/nkis/auscollabfrage.cgi?uid=guest&lang=e> (Kurz et al. 2000–2007). To create a list, just input "Micropterix" into field "Scientific name" and click on Button "Search". Each specimen has been labelled with a unique identification (ID) number representing the record number of the

database. With this ID-number, the data of each specimen can be checked individually on www.nkis.info, menu “DATA ANALYSIS”. Furthermore, these records, together with original life observations, contribute to dynamically generated distribution maps. Analyses concerning phenology, vertical distribution, biotope preferences, interactions with other organisms and many others can be generated in a similar way. All these statistics are generated from original data and do not present literature compilations, although reliable literature records may to a small extent contribute to the original data. In any case, data are tagged as to whether they originate from investigated specimens, from living observations or from literature records.

Results

Micropterix Hübner, 1825

Micropterix Hübner, 1825 b: 426. Type species: *Tinea podevinella* Hübner, 1813, by original designation. *Micropteryx* Zeller, 1839: 185 (unjustified emendation).

Eriocephala Curtis, 1839: pl. 751. Type species: *Phalaena (Tinea) calthella* Linnaeus, 1761, by monotypy.

Microptericina Zagulajev, 1983: 113. Type species: *Micropteryx amasiella* Staudinger, 1880, by original designation.

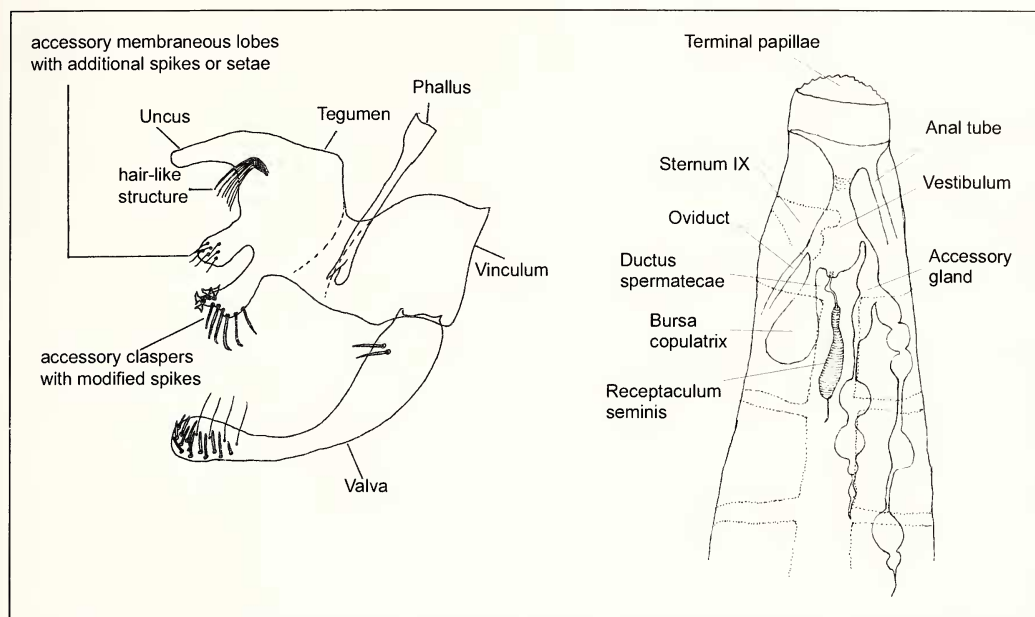
The genus *Micropterix* has been suggested to represent the sister group of all other members of the basalmost group of extant Lepidoptera (e.g. Kristensen 1984a; Kristensen & Nielsen 1979), the Zeugloptera [= Micropterigidae Herrich-Schäffer, 1855] notably on the basis of its complete lack of a hindwing vein R and retention of minute remnants of the eighth abdominal sternite in males (Kristensen 1998: 43; Hashimoto 2006: 58). However, the support for this placement was soon questioned (Kristensen & Nielsen 1982) and is now definitely known to be spurious (Skalski 1995; Davis et al., unpubl.), as is also strongly indicated by preliminary analyses of 16SrRNA molecular data (Kobayashi et al. 2002; Gibbs et al. 2004; Hashimoto 2006). The phylogenetic position of this genus within the family Micropterigidae is still quite unclear, but while it is subordinate within the hierarchy of extant taxa, it is at least clearly external to the group comprising the other Northern Hemisphere members. There are 11 currently recognized genera in the family (including those recently described by Hashimoto (2006), but disregarding undescribed genera of which a number will be needed to render *Sabatinca* Walker, 1863 monophyletic). *Micropterix* shares with most or all of these genera the presence of fully functional, asymmetrical mandibles (with apical incisor cusps only on the left mandible), and presence of antennal ascoid type sensilla (see Kristensen, 1984a: 154 for a list of another eight characters synapomorphic for Micropterigidae). Movable mandibles are not, however, unique to Micropterigidae, also occurring in the primitive genera *Agathiphaga* and *Heterobathmia*. The use of mandibles for crushing pollen or fern spores, combined with the presence of filtering structures in the mouth cavity, appears thus to have been lost independently in ancestors of *Agathiphaga* (where the mandibles are functional only in the pharate adult) and Glossata (Kristensen & Skalski 1998). There is little doubt also that all the taxa currently placed within *Micropterix*

constitute a natural group (excluding for now fossil taxa, notably *Micropterix anglica* Jarzembowski, 1980, whose fragmentary forewing venation but not probable palaeoenvironment is consistent with extant members of this genus, or any Baltic amber material that require reassessment).

The genus *Micropterix* has at least three derived traits: (1) in the wing venation all Rs branches run to the costa; (2) the male tergum I has a special muscle set inserting on an anteromedial longitudinal costa; and (3) the male abdominal segment IX has specialized dorsomedian and dorsolateral processes (Kristensen & Nielsen 1979). Also, more weakly (4) forewing R is unforked, but this trait occurs in other Northern hemisphere genera; (5) the dorsal part of the female abdominal sternite IX ring is unsclerotized (Kristensen & Nielsen 1982: 514); (6) *Micropterix* has lost the basal trait attributed to the Amphiesmenoptera of sternal V glands, although this loss has also happened elsewhere among the Micropterigidae (Kristensen 1984: 128) and (7) apyrene type of sperm is absent (so far checked in just a single species, Kristensen 1999).

Diagnosis. A number of features are plesiomorphies widespread in other homoneurous moths: head rough scaled, densely covered; ocelli prominent (as in all extant micropterigid genera); maxillary palpi long, with 5 segments, folded (as e.g. in eriocraniids). Other characters are more or less characteristic of Micropterigidae: full complement of sulci present on head; lacinia present, cardo irregular, longish; labial palpi shortened (2-segmented in *Micropterix* as in most micropterigids), with a sensory concavity (Von Rath's organ) on the basal segment; antennal sensillae (including branched 'ascoid' basiconic type as also in Opostegidae) on all segments except the two basalmost ones and the distalmost one; mandibles present and fully functional in both pupa and adult; fore tibia with epiphysis; spur formula 0-0-2 as in other micropterigids (absence of mesotibial spurs shared uniquely with Heterobathmiidae); forewing with jugum, hindwing with a row of non-coupling subcostal frenulum bristles. The *Micropterix* species of northern and central Europe, considered in this paper, have a wingspan of 5–12 mm; antennae are filiform or sub-moniliform, from 1/2 to almost forewing length, wing colouration is metallic shining, with two principal colour patterns only: golden with or without silvery spots and fasciae, or more or less purplish with golden spots and fasciae (Heath 1983; Scoble 1995; Kristensen 1999). The radial vein is unbranched in forewing as in "*Micropterix*" *anglica*, "*Sabatinca*" *porphyrodes*, and most E. Asian micropterigids (Hashimoto 2006) and the abdominal sternal V glands are absent, inferred lost, as occasional in a few tropical taxa such as *Hypomartyria* (Kristensen 1984b).

Morphology of adults. The exoskeletal and internal adult morphology of the species *Micropterix calthella* (Linnaeus, 1761) has been more or less intensively studied and readers are referred here to a few principal works. Very little is known of the detailed morphology of other species in the genus. For characteristics in wing venation, see for example Hashimoto (2006). Internal thoracic musculature of *Micropterix aureatella shikotanica* Kozlov, 1988 was treated by Kozlov (1986), whilst Kristensen (1984b) treated in detail the abdominal musculature and chordotonal organs of *M. calthella*, whose head musculature is described by Hannemann (1956). Kristensen (1984c) also treated the respiratory system of *M. calthella*. Sensillae of antennae and palps were described by Le Cerf (1926). Mouthpart sensillar ultrastructure of



Figs 2–3. Characters of genitalia referred to in the descriptions. 2. ♂. 3. ♀ (according to Kristensen in litt.).

M. calthella was described in more detail by Chauvin & Faucheux (1981). In this paper, we focus on wing pattern and comparative features of abdominal sclerites and genitalia of Palaearctic species.

Adult *Micropterix* have a forewing length of about 1.5–7 mm. On the head they bear a vestiture of hair-like scales, which, in most cases, are more or less yellow coloured, but sometimes may be dark brown or even black. The antennae of males are significantly longer in males, reaching $2/3$ – $7/8$ of the forewing length, whereas in females their length is only $1/2$ – $2/3$ of the forewing length. The forewings show a pattern of golden and usually, also purple to violet markings, which are often very species-specific. The hindwings are devoid of any markings, more or less bronzy golden with the apex tinged purple.

Pregenital abdomen. The pregenital abdomen consists of eight well developed segments. In both genders, the sclerites of segments I and II are heavily modified in shape, but the intraspecific variation of these characters is too great to be used for species-identifications. Also not useable for that purpose are all other segments including segment VIII, although sternites III–VI, as well as tergites VI–VIII often bear heavily sclerotized cross-ridges, or, seldom, a reticulate structure. In males, sternite VIII is always reduced to two tiny sclerotized platelets.

Male genitalia. Segments IX and X form the core of the genitalia, which are not retractable into the abdomen. In a few species like *Micropterix mansuetella* Zeller, 1844, the two complexes consisting of vinculum and valvae on the one hand and uncus, tegumen and two pairs of accessory claspers on the other hand, are clearly separated from each other. In most species however, the two parts are fused. Besides uncus and valvae, which are common in most other Lepidoptera, two additional clasping structures can be developed on the posterior margin of the tegumen. In *Micropterix aureatella* (Scopoli,

1763) and its relatives, both clasping structures (Fig. 2) are developed and bear normal, hair-like (hereafter “unmodified”) or bristle-like/stout (hereafter “spinoid”) setae (Fig. 123). In *Micropterix aruncella* (Scopoli, 1763) and its relatives the upper pair is developed prominently, whereas the lower pair (called accessory claspers) is more or less atrophied. In most other species of *Micropterix*, the upper pair is reduced or completely obsolete, whereas the accessory claspers are well developed.

The accessory claspers normally bear up to 3 groups of thickened setae (Fig. 124) which may be on the inner surface. Often these setae are highly modified into T- or Y-shapes (Fig. 125).

The valvae also bear spinoid setae, but these are not modified.

The phallus, describe in detail by Hannemann 1957, is somewhat enlarged at its base and shows a delicate inner structure at the posterior end. Nevertheless, these structures are not informative at species level.

Female genitalia. Segments IX and X are normally retracted into the abdomen in order to form a short ovipositor. Tergite IX is obsolete with the exception of *M. mansuetella*, where a minute fragment is left. In all other cases so far investigated only a group of setae is left instead of the tergite. Sternite IX is also reduced and modified in shape in females and, despite a reasonable intraspecific variability, often of shape informative at species-level (for example this more or less strongly sclerotized plate may show concavities at its proximal margin, or form a complete ring fused at the dorsum). Two lateral setose sclerites constituting the discrete segment X of Micropterigidae, form the terminal papillae, and form a more or less an evenly wide ring. In some cases, they also can contribute to species identification. The diagnostic features of segments IX and X are discussed in the species descriptions. The internal parts of the female genitalia are not sclerotized at all. Therefore most structures are of no value for recognizing species. Only the receptaculum seminis is distinctly cross-striated and in many cases its shape and length can contribute to species identification (Fig. 3).

Morphology of preimaginal stages (Heath 1983; Hashimoto 2006).

E g g . The eggs are oval, about 0.38×0.24 mm to about 0.53×0.43 mm (Heath 1962), translucent white with rod like structures of variable length. The eggs are deposited between the vegetation on the soil.

L a r v a . The body is elongate or barrel-shaped, whitish grey to dark grey, body length 2.5–4.5 mm; the head is almost twice as long as broad; the antennae are well developed, 3-segmented and bear a seta on their ends; they are almost as long as the width of the head; head and prothorax can be retracted into meso- and metathorax; the thoracic legs have only three free segments; the abdominal legs consist of a pair of conical appendages, bearing claws similar to the thoracic legs; the anal sucker is trilobed; each segment bears four longitudinal ridges with eight rows of paired, scale-like setae.

The larvae have been assumed to feed on small pieces of rotten leaves or perhaps fungal hyphae although observations such as collections of larvae from tussocks of *Dactylis glomerata* (Poaceae) have been tenuous (Scoble 1995: 194), but *M. calthella* and *M. aruncella* have been recorded to eat *Stellaria* spp. (Caryophyllaceae) or other angiosperm tissue in captivity although they refused mosses or liverworts (Carter & Dugdale 1982). They have been found in the soil at a depth of 10 cm in stony woodland

soil (Heath 1983) and those of *M. aureatella* have been found in a range of leaf litter where they could feed on fungal mycorrhizae (Carter & Dugdale 1982). There would appear to be only three instars (Heath 1983).

Pupa. Body length is about 2.5mm; the mandibles usually conspicuous and functional (Mosher 1916); the head and thorax with long bifurcate setae; the first seven abdominal segments are movable and the appendages are not fused to the body (Scoble 1995); the pupa rests within a tough silken cocoon. There is a nice drawing of the pupa of *M. calthella* in Lorenz (1961).

Life history. The adult moths feed on the pollen of many different plants (already detailed), and they cluster gregariously on flowers, especially on easily accessible blossoms, rather than searching for pollen grains on leaves as for example some syrphid flies. It has been demonstrated that in some cases the pollination is successful (Schwartz-Tzachor et al., 2004): e.g. in Israel, *Micropterix berytella* de Joannis, 1886 and *Micropterix elegans* Stainton, 1867 are, besides species of thrips, bees and flies, the most important pollinators of *Cyclamen persicum* Miller. For *Micropterix*, blossoms are also mating sites (Kozlov & Zvereva 2006). We have observed that copulation often lasts only a few seconds. No *Micropterix* are known to feed on fern spores as do some other micropterigid lineages in North America (Tuskes & Smith 1984) and in the Southern Hemisphere (e.g. ‘*Sabatinca*’ *porphyrodes*; Gibbs, pers. comm.), but pollen is also known as a food source for New Caledonian *Sabatinca* sensu stricto (Thien et al. 1985) and for some Australian micropterigids (Common 1990: 130).

The biotope preferences of most species have been insufficiently studied so far, but a certain constancy of soil humidity seems to be necessary for the development of the larvae, which are apparently usually detritus-living or subterranean. Therefore, the genus inhabits biotopes with higher humidity like woods and scrubland, but also moors and moist meadows, especially places where the soil is moist, whereas only few species are able to live in dryer regions. Furthermore, some correlation between the colouration of the forewing and the biotope seems to exist. Species, inhabiting wood- and bushland, i.e. places with less solar insolation, are primarily purplish to violet with golden markings, whereas species living in open habitats are more reddish golden to golden coloured without darker wing markings. Due to the higher reflection rate, such golden animals are less susceptible to overheating in direct sunlight. It is also suggested (Kozlov 1985) that visual cues are important in the absence of sternal V glands and lack of apparent pheromonal communication (despite suggestion to this effect by Pringruber (1944)) and so this could explain the bright shiny scale colours that could be the cues for conspecific aggregation irrespective of sex.

The adults of *Micropterix* are active in sunshine, although sometimes they may come to light. Depending on latitude and elevation, they swarm during a period of two or three weeks in a single generation any time from late January (southern Mediterranean area, e.g. Israel) to August (highest sites in the Alps). The actual flight period only lasts a few weeks in any locality, but the individual lifespan is poorly known. According to an experiment to prove the pollination of *Cyclamen persicum* Miller in Israel, *M. elegans* and *M. berytella* were kept in captivity for four or five days before they died (Schwartz-Tzachor, pers. comm.).

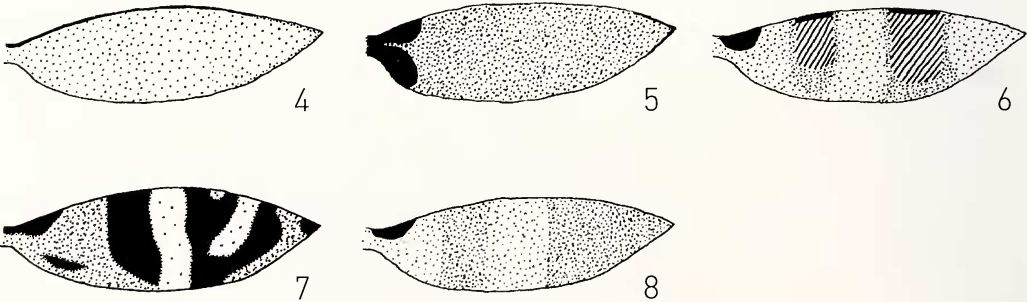
Micropterix is one of two genera of Micropterigidae (Gibbs, unpublished) with a larva that typically lives in the leaf litter zone where it may even feed on fungal hyphae as well as a probably wide range of plant material that includes living angiosperm leaf tissue and are the only micropterigids known to do so (Lorenz 1961; Carter & Dugdale 1982). Despite the diversity of species in Europe, it is remarkable that almost nothing still is known about the early stage life history, and apart from descriptions of eggs laid by females, there is knowledge only about the larva and pupa of *M. aruncella* and *M. calthella* (and larva of *M. aureatella*), for which remarks below apply.

Phylogenetic relationships. Up to now no consensus hypothesis has emerged as to the phylogenetic relationship of species within the genus *Micropterix*. The authors have identified several morphological characters, which are assumed to be autapomorphies of recognized species groups (unpublished results). This has led to an ordered arrangement of species that has been used in this paper, although for the time being this arrangement must be regarded as provisional and partly phenetic. Further studies, including DNA investigations performed by the authors will hopefully improve the presented picture.

Key to the species

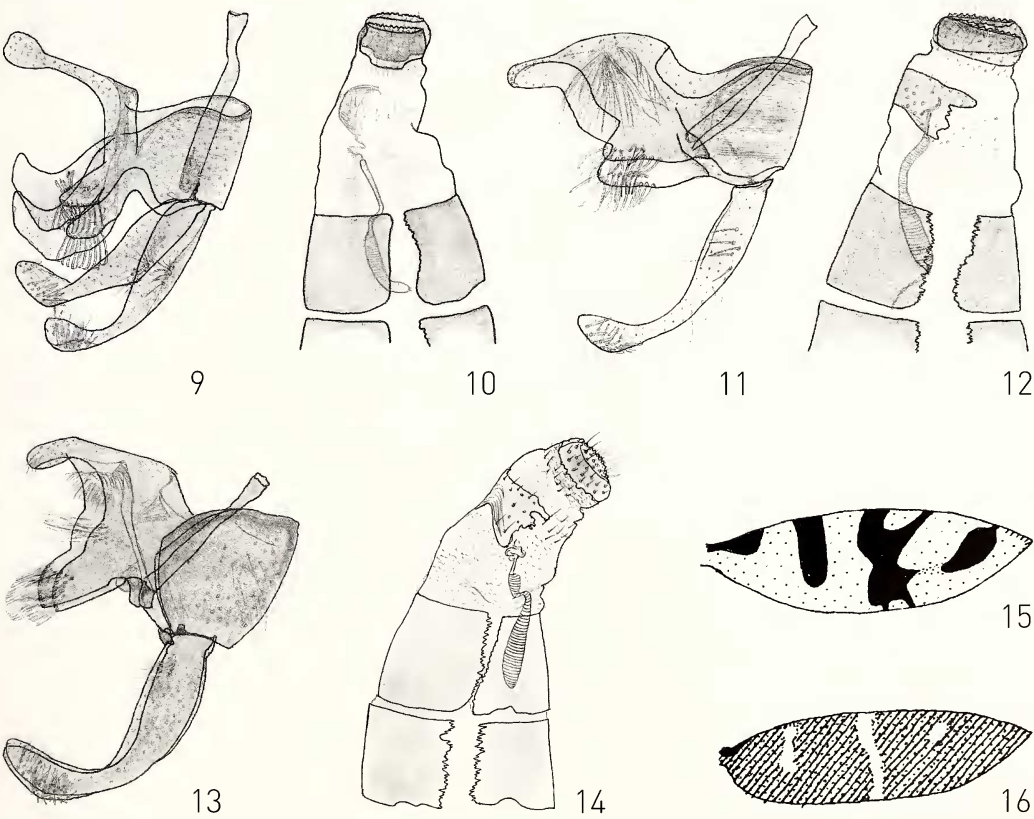
The key is based on characters observable without dissection, as far as possible.

- 1 a Forewings uniformly golden (Fig. 4), or with only minute reddish to violet markings (Fig. 5, 8) 2
- 1 b Forewings different (Figs 6, 7) 6
- 2 a Hair-like scales of head black, forwing markings see Figs 6, 8 *M. mansuetella*
- 2 b Hair-like scales of head yellow to dark brown 3
- 3 a Base of forewing purple from costa to inner margin (Fig. 5) *M. calthella*
- 3 b Only base of costa slightly purple; three taxa distinguishable only by genitalia examination (Fig. 4) 4



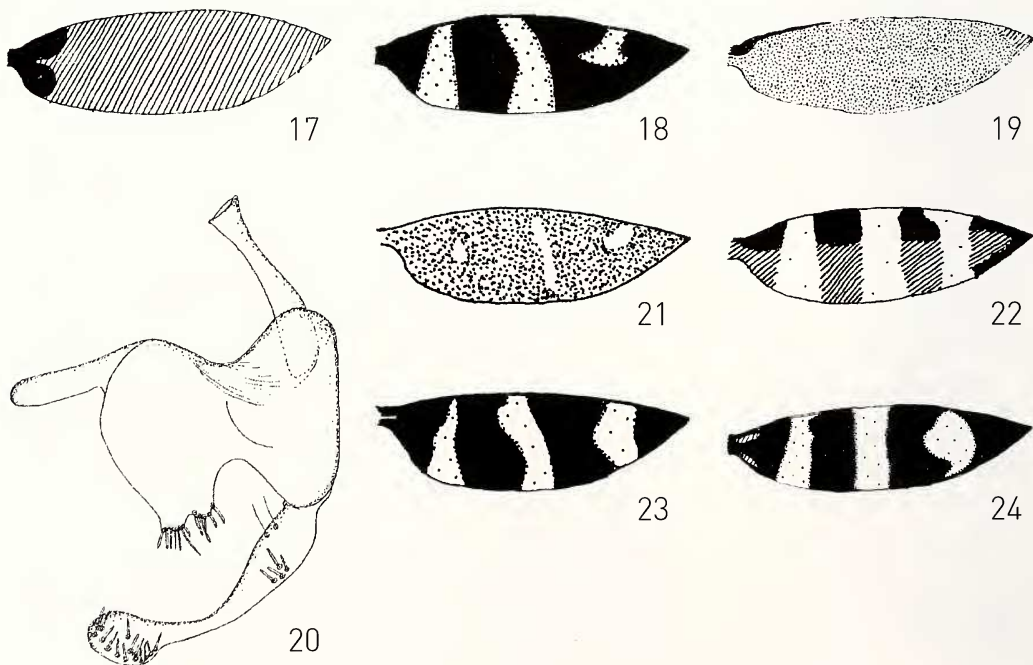
Figs 4–8. Illustrations for the “Key to the species”: Schemes of forewing drawing, ♂ genitalia and ♀ abdomen of *Micropterix*. 4. *M. isobasella*. 5. *M. calthella*. 6. *M. mansuetella*. 7. *M. osthelderi*. 8. *M. mansuetella*.

- 4a male genitalia: membranous lobe between accessory claspers and uncus prominent (Fig. 9); female genitalia: sternite IX much reduced, almost interrupted in the middle (Fig. 10); males without silvery markings known from Sardinia *M. aruncella*
- 4b male or female genitalia different 5
- 5a male genitalia: segments IX (tegumen) and X (uncus, accessory claspers) completely fused, accessory claspers with sickle-shaped spines (Fig. 11); female genitalia: not distinguishable from *M. isobasella* with certainty (Fig. 12); normally the species is deep purple violet, a golden form without markings is known only from high altitudes in the south western Alps (Marguareis), flying together with more or less marked specimens *M. paykullella*
- 5b male genitalia: segments IX and X distinctly separated from each other (Fig. 13); female genitalia: not distinguishable from *M. paykullella* (Fig. 14); distribution confined to southern Switzerland (Simplon) and adjacent regions of northern Italy at high altitudes *M. isobasella*
- 6a Forewings golden with extended purple markings, often more or less diffuse (Figs 6, 15) 7
- 6b Forewings reddish, coppery (Fig. 16), purple or deep violet with silvery or golden markings (Fig. 7) 9
- 7a Hair-like scales of head black, forewing markings see Figs 6, 8 *M. mansuetella*
- 7b Hair-like scales of head yellow to brownish 8



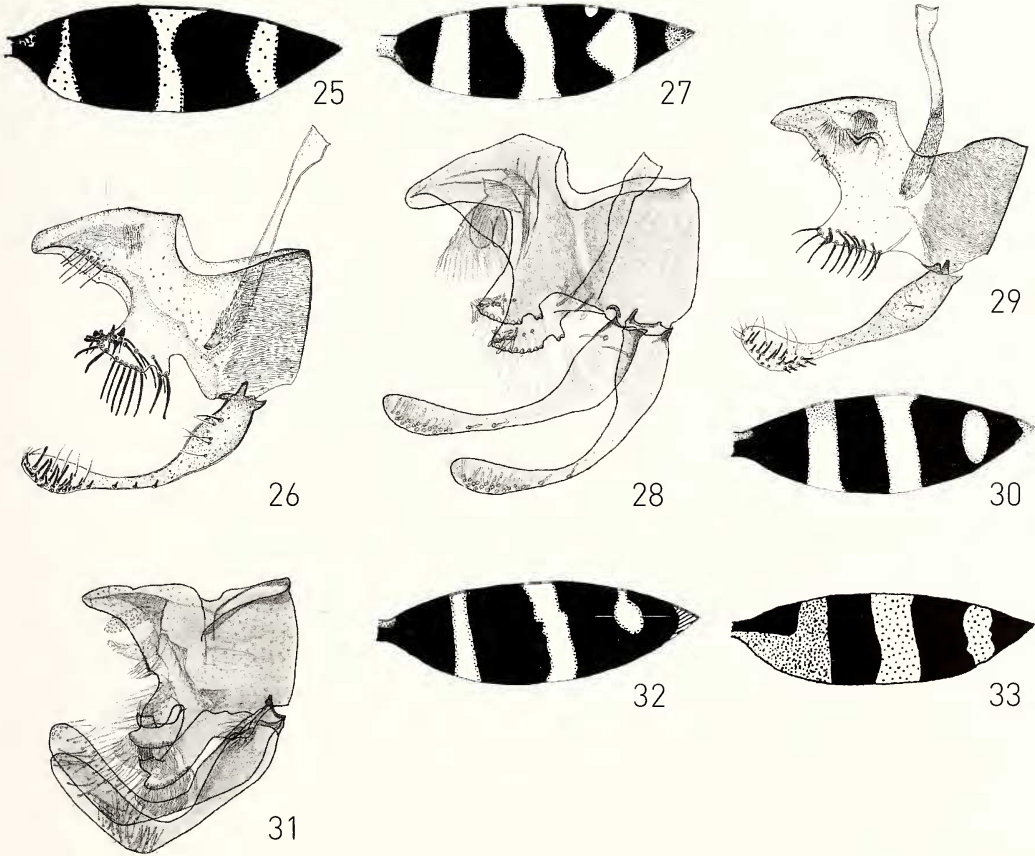
Figs 9–16. 9–10. *M. aruncella*. 11–12. *M. paykullella*. 13–14. *M. isobasella*. 15. *M. tunbergella*. 16. *M. aruncella*.

- 8a Base of forewing purple from costa to inner margin, other markings more or less diffuse (Fig. 17) *M. calthella*
- 8b Base of forewing not extensive purple; purple fascia in the centre of the wing distinctly forked at costa, embedding a small golden costal spot (Fig. 15) *M. tunbergella*
- 9a Forewings bronzy golden or coppery with more or less distinct silvery markings (Figs 16, 21); two taxa distinguishable in the male sex only by genitalia examination 10
- 9b Forewings reddish, brownish golden, purple to purple violet with more or less distinct light golden to bronzy golden wing markings (Figs 7, 18) 11
- 10a Males: lobes between uncus and accessory claspers prominent, accessory claspers spatulate (Fig. 9); females: without silvery wing markings (Fig. 19) *M. aruncella*
- 10b Males: lobes between uncus and accessory claspers missing; accessory claspers very prominent (Fig. 20, after Heath & Kaltenbach 1984); Females: silvery wing markings distinct; distribution confined to Alpi Cozie (Fig. 21) *M. fenestrellensis*
- 11a Small species: wing expanse less than 6.5 mm 12
- 11b Larger species 13
- 12a Forewings with three broad transverse fasciae reaching from costa to inner margin (Figs 22, 23) *M. rablensis*
- 12b Forewings with two broad transverse fasciae reaching from costa to inner margin and an outer prominent costal spot, reaching only to the middle of the wing (Fig. 18) *M. myrtetella*
- 13a Forewings with three transverse fasciae reaching from costa to inner margin; a small costal spot may be present (Figs 24, 25) 14
- 13b Forewings with additional or other wing markings (Fig. 7) 17
- 14a Outer transverse fascia triangular and extremely broad (Fig. 24) 15



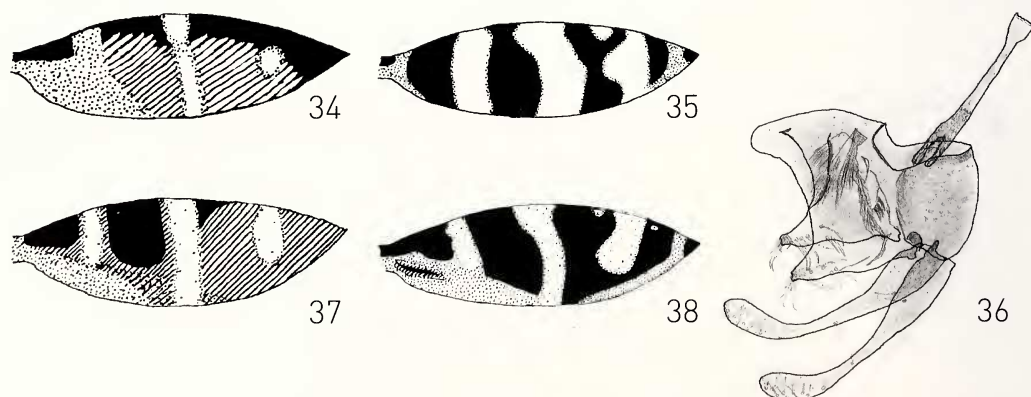
Figs 17–24. 17. *M. calthella*. 18. *M. myrtetella*. 19. *M. aruncella* ♀. 20–21. *M. fenestrellensis* (♂ genitalia after Heath & Kaltenbach 1984). 22–23. *M. rablensis*. 24. *M. trifasciella*.

- 14b Outer transverse fascia narrower, sometimes not completely reaching costa or inner margin (Fig. 25) 16
- 15a Small costal spot normally absent (Fig. 24); male genitalia: accessory claspers slightly shorter and broader; spines beyond uncus normally present (Fig. 26); female genitalia: not distinguishable from *M. allionella*; distribution confined to a small region in the French-Italian border area *M. trifasciella*
- 15b Small costal spot normally present, often remnants of a bronzy golden outer margin also present (Fig. 27); male genitalia: accessory claspers slightly longer and smaller (Fig. 28); female genitalia: not distinguishable from *M. trifasciella* *M. allionella*
- 16a Outer transverse fascia always reaching costa and inner margin (Fig. 25); male genitalia: lobes between uncus and accessory claspers completely atrophied (Fig. 29); female genitalia: unknown; distribution confined to high altitudes in the south western Alps (only known from type locality Marguareis) *M. huemeri*
- 16b Outer transverse fascia normally not reaching costa and inner margin (Fig. 30); male genitalia: lobes between uncus and accessory claspers distinctly developed (Fig. 31); female genitalia: receptaculum seminis moderately long) *M. aureatella*
- 17a Posterior margin not bronzy golden (Fig. 32), or if bronzy golden, this colouration not extending to fascia at 1/2 (Fig. 33) 18



Figs 25–33. 25. *M. huemeri*. 26. *M. trifasciella*. 27–28. *M. allionella*. 29. *M. huemeri*. 30–32. *M. aureatella*. 33. *M. aglaella*.

- 17b Posterior margin more or less distinctly bronzy golden from base to fascia at 1/2 (Fig. 7) **22**
- 18a Forewings markings: Two transverse fasciae at 1/4 and 1/2 and an outer spot, often almost reaching costa and posterior margin (see also 13) (Fig. 32) *M. aureatella*
- 18b Additional markings developed (Figs 33, 27) **19**
- 19a Posterior margin without any bronzy golden area; outer transverse fascia very broad and triangular, extending across the whole wing width (Fig. 27) **20**
- 19b Posterior margin with bronzy golden area (Fig. 33), sometimes almost reaching fascia at 1/2 (Fig. 34); outer transverse fascia narrower, often not extending across the whole wing width and normally not triangular **21**
- 20a Transverse fasciae extremely broad, sometimes fused with costal spot; outer bronzy golden margin well developed (Fig. 35); male genitalia: accessory claspers broad triangular, proximal spines not on a separate stylus (Fig. 36); female genitalia: not distinguishable from *M. allionella* *M. rothenbachii*
- 20b Transverse fasciae at 1/4 and 1/2 smaller; outer bronzy golden margin often reduced (especially males) (Fig. 27); male genitalia: accessory claspers not broad triangular, two proximal spines on a separate stylus (Fig. 28); female genitalia: not distinguishable from *M. rothenbachii*, *M. allionella*
- 21a Bronzy golden wing base almost extending to fascia at 1/2 at posterior margin; outer margin of the bronzy golden area and fascia at 1/2 therefore not parallel (Fig. 34) *M. paykullella*
- 21b Bronzy golden wing base not extending towards fascia at 1/2; outer margin of the bronzy golden area and fascia at 1/2 therefore parallel (Fig. 33) *M. aglaella*
- 22a Ground colour often more or less reddish, light golden markings often indistinct; small costal spot missing (Fig. 37) *M. aureoviridella*
- 22b Ground colour distinctly purple to bluish violet; markings distinctly golden; small costal spot always present) (Fig. 7) **23**
- 23a Inner transverse fascia light golden in its centre above bronzy golden inner margin (Fig. 38) *M. schaefferi*
- 23b Inner transverse fascia and inner margin completely bronzy golden (Fig. 7) *M. osthelderi*



Figs 34–38. 34. *M. paykullella*. 35–36. *M. rothenbachii*. 37. *M. aureoviridella*. 38. *M. schaefferi*.

Checklist of northern and central European species

Micropterix mansuetella Zeller, 1844

= *Lampronia ammanella* (Hübner, 1813) sensu Wood, 1839

Micropterix calthella (Linnaeus, 1761)

= *Tinea urticella* Costa, 1834

= *Eriocephala sulcatella* Bentley, 1845

= *Micropteryx silesiaca* Toll, 1942

Micropterix isobasella Staudinger, 1871

Micropterix aglaella (Duponchel, 1838)

Micropterix aureatella (Scopoli, 1763)

= *Tinea paykullella* Thunberg, 1794

= *Tinea ammanella* Hübner, 1813

Micropterix aruncella (Scopoli, 1763)

= *Tinea seppella* Fabricius, 1777

= *Tinea podevinella* Hübner, 1813

= *Lampronia concinnella* Stephens, 1834

= *Micropteryx eximiella* Zeller, 1850

= *Eriocephala atricapilla* Wocke, 1877

= *Micropteryx nuraghella* Amsel, 1936

Micropterix tunbergella (Fabricius, 1787)

= *Tinea helwigella* Hübner, 1805

= *Tinea rubrifasciella* Haworth, 1828

= *Micropteryx depictella* Herrich-Schäffer, 1851

Micropterix aureoviridella (Höfner, 1898)

= *Micropterix liogierella* Réal, 1987

Micropterix paykullella (Fabricius, 1794)

= *Tinea anderschella* Hübner, 1813

= *Micropterix paykullella* [sic!] f. *rosarum* Müller-Rutz, 1927

Micropterix allionella (Fabricius, 1794)

= *Tinea tricinctella* Costa, 1836

Micropterix trifasciella Heath, 1965

Micropterix rothenbachii (Frey, 1856)

= *Micropterix australis* Heath, 1981a

= *Micropterix vallebenella* Réal, 1988

Micropterix huemeri Kurz, Kurz & Zeller, 2004

Micropterix schaefferi Heath, 1975

= *Micropteryx anderschella* (Hübner, 1813) sensu Herrich-Schäffer, 1851

Micropterix osthelderi Heath, 1975

Micropterix fenestrellensis Heath & Kaltenbach, 1984

Micropterix rablensis Zeller, 1868

Micropterix myrtetella Zeller, 1850

***Micropterix mansuetella* Zeller, 1844**

Micropterix mansuetella Zeller, 1844: 16. Type locality: "Groß-Glogau" (now: Glogów, Poland).

Lectotype: in coll. BMNH.

Lampronia ammanella (Hübner, 1813) sensu Wood, 1839: 231, pl. 50.

Misidentification.

Description of adults. Examined: 9♂, 10♀. Forewing length: ♂ 3.4–3.9 mm; ♀ 3.8–4.2 mm. Head black; vestiture of hair-like scales on the head black-brown to black, golden fuscous; antennae 4/5 (♂), respectively, 1/2 (♀) of forewing length, dark brown at base, distal parts lighter brown, golden fuscous; thorax dark golden, prothorax posteriorly with purple and bluish scales; tegulae purple, posteriorly edged bluish; forewing golden with bronzy golden to reddish golden pattern, especially in the southern part of the species' geographic range the reddish golden markings often only faintly developed or, in males, almost oblique: a purple costal spot near the base; a broad, diffuse fascia at 1/3, narrowing towards inner margin, sometimes disrupted near the costa, sometimes purplish at the anterior margin and in the middle; a very broad, diffuse fascia at 3/4, purplish at costa, usually hardly distinguished from the bronzy golden apical part; cilia brightly golden; hindwings bronzy golden, especially at apex with purple tinge; cilia brightly bronzy golden with faint purple tinge; legs dark golden fuscous; abdomen golden brown.

♂ **Genitalia.** Uncus moderately long, broad, stout, distal with some short setae, forming a separate, clearly distinguishable unit with accessory claspers; accessory claspers moderately long, enlarged distally, anterior margin almost S-shaped, with short, stout thickened setae, which have spatulate bases and short, hook-like ends, pointing backwards; a row of shorter, unmodified setae near anterior margin; valvae rather short, stout, strongly narrowed near mid-length, with clearly distinguished ends; a small, basal group of short setae at inner surface, postbasally a larger, elongated group of short setae; several rows of very short to moderately long, spinoid setae at inner surface of distal ends.

♀ **Genitalia.** Sclerites of segment IX reduced, forming a complete sclerotized ring: ventral half of normal width, ventrolaterally the proximal part lobe-shaped and enlarged; dorsal third of normal width, laterally slightly constricted; distal margin of ring with straight, sharp border, proximal margin of ring dorsolaterally irregular, faintly sclerotized. Terminal papillae strongly sclerotized, distal margin straight, proximal margin irregular; ductus receptaculi short, sharply bent, very narrow at onset of receptaculum seminis; onset of receptaculum seminis slightly enlarged, upper third constricted and slightly bent; afterwards forming a curved and slender sac; lower end with characteristic, semicircular appendix.

Diagnosis. The species might be confused with worn specimens of *M. tunbergella* or with *M. calthella*. It differs, however, from all European species by the blackish scales on the head. Only *M. aruncella* from alpine locations has comparable dark scales. *M. aruncella* usually inhabits different biotopes (nutrient-poor meadows versus swamp-land) and is found at higher elevations (although sometimes syntopic). The wing colour is greener in *M. aruncella*, having a distinct purple base at the costa. Adults are

also usually smaller than *M. mansuetella*, with hair-like scales on the head less dark.

Distribution. According to Heath (1996) and Karsholt (2004) this species occurs in northern, eastern, central and western Europe (including Great Britain and Ireland). Heath (1983) reports this species local in northern Europe as far south as Bavaria (Germany). Meyrick (1912) depicts Europe, without further specification. Meeß (1910) reports the species from central, western (including England) and northern Europe. The records from Italy (Heath 1996; Hartig 1964) respectively seem to be doubtful and those from Portugal (Meeß 1910; Heath 1996) belong to the recently described *Micropterix herminiella* Corley, 2007.

The investigated specimens from the collection of Klimesch (now ZSM) are from the Austrian alpine regions: Edlbach-Moor (Upper Austrian) and Selzthal-Moor (Styria). Deutsch (pers. comm.) also collected the species in Eastern Tyrol (Austria), which is as far as we know the most southern occurrence of this species.

Life history. We collected specimens from flowering sedges (*Carex* spp.) in open woodland (*Fraxinus-Salix*-association) at the border of fens. Klimesch (pers. comm.) found the species favoured swamplands, feeding on sedges in birch-groves. Deutsch (pers. comm.) reports its occurrence in a ditch with *Alnus incana* L. next to a small woody moorland slope. The species seems to be absent from higher mountain regions.

Preimaginal stages. According to Heath (1962, 1983), the egg has an oval shape, a length of 360–490 μm and a width of 260–330 μm , with up to 140 μm long, rod-like structures. Immediately before hatching, the translucent white colour turns to grey. The larva and pupa are unknown.

Micropterix calthella (Linnaeus, 1761)

Phalaena (Tinea) calthella Linnaeus, 1761: 367. Type locality: Sweden. Lectotype: in coll. LSUK.

Tinea urticella Costa, 1834: 10–11, pl. 2 figs 1a–c. Type locality: Camaldoli (Capodimonte, Napoli, Italy).

Junior subjective synonym.

Eriocephala sulcatella Bentley, 1845: 1086–1087. Type locality: London (Great Britain). Junior subjective synonym.

Micropteryx silesiaca Toll, 1942: 171. Type locality: Ustron (Poland). Junior subjective synonym.

Description of adults. Examined: 13♂, 43♀. Forewing length: ♂ 3.1–3.7 mm; ♀ 3.6–4.6 mm. Head black-brown; vestiture of hair-like scales on the head dirty white to rusty yellow; antennae brown, golden shining, with reddish tinge, 4/5 (♂), respectively, nearly 3/5 (♀) of forewing length; thorax bronzy golden to coppery, posteriorly sometimes purple mixed; tegulae coppery to bluish violet; forewing bronzy golden, brownish golden to slightly greenish golden, usually without any markings; the basal area from costa to inner margin, more or less extended, purple to purplish violet, sometimes with single bluish scales; ground colour occasionally intensely tinged purple or with rudiments of vague purple markings present; these consist of a costal spot near 1/4 and a similar spot at 2/3, the latter extending almost across the whole width of the wing; fringe light bronzy golden to whitish golden, sometimes with a purple tinge; hindwing light bronzy golden, sometimes more or less purplish at the apex; fringe light bronzy

golden, brighter at the distal margin, sometimes with a purple tinge; legs and abdomen brown, golden shining, sometimes slightly purplish.

A great deal is known about the internal anatomy and exoskeletal ultrastructure of the adult of this species (see section: Morphology of adults). Below we describe the broad morphology of the abdomen only.

♂ **Genitalia**. Uncus moderately long and slender; ventrally beyond the uncus a tuft of long hair-like setae; accessory claspers well developed, nearly trapezoid; their rounded anterior margin with a row of seven or eight very short, thickened setae of spoon-like to spatulate shape; at the lower apex of the anterior margin a row of three similar but longer, straight thickened setae, which are partly hook-shaped at their ends; valvae moderately long, distinctly constricted medially, the distal fourth spatulately enlarged, bent upwards; at their inner surface postbasally two or three shorter, straight spinoid setae; the distal fourth at the inner surface with two to four irregular rows of moderately long to very short, straight spinoid setae.

♀ **Genitalia**. Tergite IX missing; sternite IX much reduced, moderately sclerotized, sometimes with indistinct margins, but of relatively characteristic shape. Segment X (terminal papillae) with sclerotized band; ductus receptaculi very thin; receptaculum seminis long and slender, at the beginning slightly thickened, the first half straight, very slender, without transverse striation; the second half enlarged into a curved, elongate sac with somewhat irregular transverse striation; a thin appendix at the end.

Diagnosis. *M. calthella* may be confused with other unicolorous golden species without markings like *M. isobasella*., unmarked forms of *Micropterix sicanella* Zeller, 1847 and *M. paykullella*, *Micropterix garganoensis* Heath, 1960 and the female of *M. aruncella*. From these, *M. calthella* is separated mostly by its darker (more greenish or brownish) bronzy golden ground colouration, as well as by its distinct purple colouration of the forewing base, reaching from costa to the inner margin. *M. mansuetella* with indistinct markings also may be very similar, but is readily distinguished by its black scales on the head.

In the male genitalia, *M. calthella* is well characterized.

Distribution. According to Heath (1983) and Karsholt (2004), the species is distributed across Europe to central Siberia. *M. calthella* has not been recorded from Iceland, the Iberian Peninsula, southern Balkans and from the Mediterranean islands (Heath 1996).

Life history. *M. calthella* inhabits moist but not saturated locations such as marshy areas, forest tracks and outskirts of the forest. The adults feed on easily accessible pollen of a wide variety of different herbaceous plants (such as *Ajuga*, *Cardamine*, *Mercurialis*) and even occasionally trees (*Crataegus*, *Acer*), but they strongly favour sedges (*Carex* spp.), kingcup (*Caltha palustris*) and buttercups (*Ranunculus* spp.).

Preimaginal stages. According to Heath (1983), the egg has an oval shape, a length of 450–480 μm and a width of 350–370 μm , with up to 60 μm long, rod-like structures. Immediately before hatching, the translucent white colour is turns to grey. Chauvin & Chauvin (1980) also describe the egg.

The larva (see general description above, under Life history) is described by Martinova (1950) and Hamon & Chauvin (1995).

The pupa rests in a compact cocoon. More about the pupa can be found in Lorenz (1961) and Hamon & Chauvin (1995).

Remarks. We found this species near Siena (Tuscany, Italy), which is as far as we know the most southern occurrence of this species. The records from Napoli (Campania, Italy) (for *Tinea urticella* Costa, 1834) should be verified.

Micropterix isobasella Staudinger, 1871

Micropterix isobasella Staudinger, 1871: 289. Type locality: Italy, western Alps, Macugnaga. 6 syntypes in coll. ZMHB.

M. isobasella f. *weberi* Müller-Rutz, 1927; infrasubspecific.

Description. Examined: 2♂, 5♀. Forewing length: ♂ 3.5–3.8 mm; ♀ 3.0–4.4 mm. Head black-brown; vestiture of hair-like scales on the head rusty yellow; antennae dark brown, coppery shining, slightly more than 3/4 (♂), respectively, slightly more than 1/2 (♀) of forewing length; thorax bronzy golden; tegulae bronzy golden, posteriorly with single purple scales; forewing golden with a greenish tinge; costal margin purplish up to 3/4; almost invisible bronzy golden transverse fasciae or spots at 1/3 and 2/3, seldom of diffuse reddish colour (f. *weberi* Müller-Rutz); base slightly darker, the darker colouration extending from costa across 1/3 of forewing width; fringe light golden, with a purple tinge, especially at its base; hindwing bronzy golden, fringe golden, both with a purple tinge; legs and abdomen brown, golden shining.

♂ **Genitalia.** Uncus moderately long, somewhat stout, with a broad tip; a paired association of hair-like setae ventrally beyond the uncus; accessory claspers moderately long, nearly keel-shaped, with about 11–12 elongate, straight, unmodified setae at the rounded distal margin; another irregular row of five or six shorter, finer setae, which are more inwardly located (shape not characterised as mostly folded in the permanent preparation); an area of long, straight spinoid setae dorsal of the accessory claspers; valvae moderately long, stout, distal third enlarged and strongly bent upwards (constricted at the point of inflection); on the inner surface of the valvae three shorter setae postbasally; on the inner surface of the lower margin two to three irregular rows of shorter spinoid setae and some longer setae on the distal fourth.

♀ **Genitalia.** Tergite IX missing; sternite IX reduced, constricted medially, with strongly fringed lateral margins, without diagnostic features. Terminal papillae with two sclerotized plates forming an undiagnostic band; ductus receptaculi thin and strongly bent, at the beginning of the receptaculum seminis short and straight; receptaculum seminis long and slender, constricted in the first third, with typical transverse striation.

Diagnosis. *M. isobasella* can be separated from *M. calthella* and from females of *M. aruncella* by its almost complete lack of purple colouration at the forewing base. *M. calthella* has an extended purple basal area, whereas females of *M. aruncella* have only the base of the costa purplish coloured (males of *M. aruncella* are characterized by their silvery fasciae). *M. isobasella* has only a slight purple colouration along the costa. In the highly mountainous southwestern Alps, a form of *M. paykullella* has been found, more or less without any markings. This form can be distinguished from *M. isobasella*

only by examination of the male genitalia. Also very similar and therefore externally not distinguishable is a form without markings of *Micropterix sicanella* Zeller, 1847 (f. *obsoleta* Heath, 1963). All above-mentioned species can be easily identified by examination of the male genitalia. In the female genitalia, only *M. aruncella* can be recognized with some certainty by its reduced sternite IX and by the somewhat protruding terminal papillae. Females of the other three species cannot be identified with certainty due to their intraspecific variability.

Further species without wing markings do not occur in the distribution range of *M. isobasella*. These are restricted to central Italy and northern Africa.

Distribution. According to Heath (1996) this species is restricted to Italy and Switzerland, where it seems to be distributed only in southern Switzerland and the adjacent northern Italy (Meeß 1910; Meyrick 1912).

Records from Sicily probably belong to *Micropterix sicanella* Zeller, 1847 (f. *obsoleta* Heath, 1963), records from North Africa to *Micropterix constantinella* Heath, 1986 or to *Micropterix eatoniella* Heath, 1986.

The examined specimens were found in Switzerland (area of Simplon).

Life history. Two of the examined specimens were found swarming around *Lonicera* sp.. Further records are from tall herbaceous vegetation in a mixed larch-pine forest at 1650–1800 m elevation.

Preimaginal stages. The early stages are unknown.

Remarks. *M. isobasella* f. *weberi* Müller-Rutz, 1927 from Switzerland (Laquintal) has two slight reddish cross-fasciae on the forewing.

Micropterix aglaella (Duponchel, 1840)

Adela aglaella Duponchel, 1840: 627, pl. 312 fig. 14. Type locality: Central and Southern France (including 'Fonscolombe', north of Aix-en-Provence). Syntype in coll. MNHN (Minet in litt.).

Description. Examined: 5♂, 12♀. Forewing length: ♂ 3.3–3.6 mm; ♀ 3.5–4.3 mm. Head black brown, vestiture of hair-like scales on the head white to rusty yellow; antennae dark brown, golden shining with a purple tinge, nearly 4/5 (♂), respectively, nearly 3/5 (♀) of forewing length; thorax bronzy golden, posteriorly reddish to purple, tegulae coppery to purple violet; ground colour of forewing reddish golden to purple violet, distal half sometimes purplish brown, outer margin sometimes reddish golden again, apex rarely also of this colour; a bronzy golden colouration from the base to 1/4, leaving a purple violet basal spot at costa; markings light golden to golden, delicately bordered in bronzy gold: a broad fascia at 1/2, slightly bent outwards, extending across the whole width of the forewing; sometimes a small costal spot at 3/5 (found in 7 of 17 specimens); a larger, almost round to slightly oval spot at 3/4, extending from costa across more than half, sometime even across whole forewing width (in the latter case the posterior part of this fascia bronzy golden); fringe golden, basally purple coloured, outwards whitish; hindwing bronzy golden, with an intense purple tinge; fringe bronzy golden, outwards whitish; legs and abdomen brown, golden shining.

♂ **Genitalia.** Uncus moderately long, stout, with a broad, rounded tip; beyond the uncus a weak structure of hair-like setae; between uncus and accessory claspers are

situated weakly sclerotized, elongated, spatulate-like lobes, somewhat variable in the length, at the anterior margin of the tegumen; these lobes with very long hair-like setae at their ends, as well as on a small appendix at their lower margin; accessory claspers spoon-like, with a row of nearly 13 moderately long to long, mostly sickle-shaped thickened setae; near the dorsal margin anteriorly two shorter, straight spinoid setae anterior and basally a row of about 6 strongly modified, very broad T-shaped thickened setae; valvae moderately long, stout, strongly constricted medially; at their inner margin a very long and a shorter seta basally, on the distal part a group of very short to rather long spinoid setae, clustered proximally towards the constriction; a row of short spinoid setae along the rounded anterior margin.

♀ **Genitalia.** Tergite IX missing, only indicated by a group of setae; sternite IX strongly reduced, weakly sclerotized, constricted medially. Terminal papillae consisting of two somewhat weakly sclerotized plates forming a band; receptaculum seminis more or less short and stout, the second half like a sac, with typical striation; vestibulum a large sac, without any special characters.

Diagnosis. This species can be confused with *M. paykullella*, but in most cases it can be recognized by its less intense purple colouration. In contrast to *M. paykullella* and *M. aureoviridella*, the golden inner margin of *M. aglaella* does not reach the fascia in the middle (the border of the bronzy golden inner part of the wing and the fascia in the middle are often nearly parallel). The outer spot at 3/4 extends across the entire width of the forewing in many cases. *M. aglaella* can also be separated from *M. aureoviridella* by the normally more acute shape of its markings, the darker purple colouration and by its consistently bronzy golden forewing base.

The male genitalia resemble somewhat those of *M. aureatella*, but can be easily distinguished. Also the female genitalia can be recognized quite well. In particular, the degree of sclerotization of sternite IX and of the terminal papillae of *M. aglaella* is distinctly weaker than that of *M. paykullella*. The receptaculum seminis seems to be shorter and stouter, but these differences are too minor to be useful.

Distribution. According to Heath (1996) and Karsholt (2004) this species occurs in Spain, France, Italy, Germany and Switzerland.

The records from Portugal (Heath 1996; Karsholt 2004) seem to be doubtful (Corley 2007).

To our present knowledge, *M. aglaella* is distributed in southern France, western Switzerland, the southern Alps (eastwards as far as Mt. Baldo, Italy), as well as in the Pyrenees. The record for the Schwäbische Alb (Germany) (Pröse 1987) has also been confirmed.

Life history. We have no modern information so are unable to confirm Duponchel's (1840: 628) records of his species from flowers of 'troène' (= *Ligustrum vulgare*), 'sureau' (= *Sambucus*) and 'cornouiller sanguin' (= *Cornus sanguinea*).

Preimaginal stages. The early stages are unknown.

Remarks. According to Minet (in litt.) the year of description has to be corrected to 1840 (all types are labelled as *Micropterix aglaella* Duponchel, 1840 instead of 1838).

***Micropterix aureatella* (Scopoli, 1763)**

Phalaena aureatella Scopoli, 1763: 254. Type locality: Slovenia, Carniola. Type: Lost or destroyed in coll. IEUP (Evenhuis 1997).

Tinea paykullella Thunberg, 1794: 89. Type locality: "Vestrogothia" (Sweden). Homonym of *Alucita paykullella* Fabricius, 1794.

Tinea ammanella Hübner, 1813: pl. 57 fig. 388. Type locality: None given. Junior subjective synonym.

Description. Examined: 19♂, 32♀. Forewing length: ♂ 3.9–4.6 mm; ♀ 4.2–4.8 mm. Head black-brown; vestiture of hair-like scales on the head brownish yellow to light ochre; antennae dark brownish golden with a light purple tinge, 4/5 (♂), respectively, 4/7 (♀) of forewing length; thorax dark bronzy golden, posteriorly partly purplish, tegulae purplish violet, posteriorly sometimes with single bluish scales; forewing purplish violet, to some extent with single bluish scales, sometimes bronzy golden with a purplish violet tinge; markings golden, delicately bordered in bronzy gold and of variable width; an indistinct and minute bronzy golden spot at the base; a fascia near 1/4, slightly bent inwards and slightly narrowed at the costa or in the middle, sometimes not reaching the costa; a fascia at 1/2, equal in width, somewhat bent outwards and sometimes narrowed in the middle; at 3/4 a broad, more or less oval spot of irregular shape, mostly reaching costa but not inner margin; fringe whitish golden; hindwing bronzy golden, more or less with a purplish tinge; fringe bronzy golden, distally whitish; legs light brownish golden; abdomen golden brown.

♂ **Genitalia.** Uncus short, somewhat stout; ventrally beyond the uncus two unsclerotized small lobes bearing humps; between these and the accessory claspers two lobe-shaped appendices at the anterior margin with long hair-like setae, above them a row with shorter setae; accessory claspers long, narrow, spatulate, at the apex with a small dorsally oriented lobe with short spinoid setae; accessory clasper on the ventral margin with numerous, long, bent spinoid or sickle-shaped setae, which are ventrally oriented; valvae long, strong, constricted medially, with many setae postbasally; the last third bent upwards and distinctly enlarged with many spinoid setae (two clusters of spinoid setae, one at the point of inflection and one at the apex).

♀ **Genitalia.** Tergite IX missing, sternite IX reduced, distinctly constricted medially, laterally enlarged into a lobe, strongly sclerotized, usually making the margins distinct. Terminal papillae with sclerotization in a band; receptaculum seminis long, narrow, at the beginning of the ductus receptaculi somewhat enlarged, forming a sac in the second half with typical striation; receptaculum seminis with a short appendix at the end.

Diagnosis. *M. aureatella* can be separated from most other purple-violet and golden species of *Micropterix* by its lack of a golden inner margin of the forewing, the more regular golden fasciae as well as the lack of the small golden spot at the costa at about 3/5. *M. trifasciella*, also without this spot, usually has broader golden fasciae. In some cases *M. aureatella* and *M. trifasciella* can be separated only by examination of the genitalia. The type locality of *M. trifasciella* is in the area of Torino (Fenestrelle, Val Susa, the border region of Italy and France). Also *M. huemeri*, found in the Alpes Maritimes (France), has a similar wing pattern. *M. aureatella* can also be separated with certainty by the male genitalia from the somewhat smaller species *M. rablensis* and *M. croatica*.

Sometimes the costal spot of *M. allionella* can be missing and then it can be confused also with *M. aureatella*. *Micropterix wockei* Staudinger, 1870, occurring in Greece, also looks superficially very similar to *M. aureatella*.

The structures of the female abdomen (segment IX and X) of *M. aureatella* sometimes look similar to those of *M. aureoviridella*, but sternite IX of *M. aureatella* is normally more strongly sclerotized with thus more distinct lateral margins.

Distribution. According to Heath (1996) and Karsholt (2004), *M. aureatella* is distributed throughout Europe except Spain, Iceland, Luxembourg, Albania, Bulgaria, the European part of Turkey and the Mediterranean islands. Also Heath (1983) records this species throughout the Palaearctic region, except northern Africa (Heath 1983).

The records from Portugal (Heath 1996) seem to be doubtful (Corley 2007).

The typical subspecies is replaced by ssp. *shikotanica* Kozlov in the eastern part of the Palaearctic region. This subspecies seems to differ clearly from the typical ssp. *aureatella* and therefore may present a separate species (Kozlov 1988, 1989; Moriuti 1982). The presence of the species in Japan is remarkable considering its long geological separation; the two populations in Hokkaido and Honshu have slightly different wing pattern but have not been placed to any subspecies (Hashimoto, 2006).

Life history. This species occurs especially in high moorland, where the moths have been found swarming around flowering *Pinus mugo mugo* Turra, *Vaccinium myrtillus* L. and also *Carex* spp. in full sunshine. In Hokkaido, Japan, the species is recorded on flowers identified as *Heracleum lanatum* Michx. var. *lanatum* (Hashimoto 2006: Fig. 11 O; U. Jinbo, pers. comm.). In mountain areas, *M. aureatella* inhabits mainly in elfin woodland in similar biotopes. This species can sometimes be found at the edges of forest openings and forest tracks, on more or less acid soils.

Preimaginal stages. According to Heath (1962, 1983), the egg has an oval shape, a length of 470–530 μm and a width of 370–430 μm with rod-like structures. Immediately before hatching, the translucent white colour turns grey. The larvae have been found in the strongly mycorrhizal leaf litter of bilberry plants and of oak and beech woodland (Carter and Dugdale, 1982). The pupa is unknown.

Remarks. The male genitalia figured by Viette (1948) as *M. aureatella* probably belongs to *M. trifasciella*.

Micropterix aruncella (Scopoli, 1763)

Phalaena aruncella Scopoli, 1763: 254. Type locality: Slovenia, Carniola. Type: Lost or destroyed in coll. IEUP (Evenhuis 1997).

Tinea seppella Fabricius, 1777: 296. Type locality: England (Karsholt in litt.). Junior subjective synonym.

Tinea podevinella Hübner, 1813: pl.50, fig.342. Type locality: None given. Junior subjective synonym.

Lampronia concinnella Stephens: 361. Type locality: Darenth wood (Great Britain). Junior subjective synonym.

Micropteryx eximiella Zeller, 1850: 62. Type locality: Montenero (near Livorno, Tuscany, Italy). Junior subjective synonym.

Eriocphala atricapilla Wocke, 1877: 52. Type locality: Stelvio (Italy). Junior subjective synonym.

Micropteryx nuraghella Amsel, 1936: 364. Type locality: Tempio Pausanias (Sardinia, Italy). Junior subjective synonym.

Description of adults. Examined: 90 ♂, 71 ♀. Forewing length: ♂ 2.6–3.6 mm; ♀ 2.6–4.0 mm. Head black-brown, vestiture of hair-like scales on the head dirty white to rusty yellow, sometimes brownish golden to blackish (f. *atricapilla* Wocke); antennae dark brown, reddish golden shining, nearly 4/5 (♂), or somewhat over 1/2 (♀) of forewing length; thorax bronzy golden to coppery, posteriorly often purple; tegulae purple to bluish; forewing golden to bronzy golden (seldom light golden), with more or less reddish tinge, which is sometimes missing; in specimens from the northern and central Apennines ground colouration often reddish bronzy golden to coppery; basal area mostly distinct purple at the costa, to some extent with single bluish scales; this purple colouration sometimes extending to 1/4 along the costa, sometimes nearly completely missing; apex in most specimens slightly more reddish than ground colour; ♀ mostly without any other markings, but specimens from the northern and central Apennines similar to males; ♂ with silvery white, often diffusely, but in specimens from the northern and central Apennines markings very distinct (markings missing in f. *nuraghella* Amsel): a narrow fascia near 1/4, not reaching costa but extending across more than half of the forewing width (strongly bent inwards and sometimes reduced to a small spot); a narrow, quite straight fascia, mostly extending across the whole width of the forewing at 1/2; sometimes a small, round spot in the anterior half of the wing at 3/4 (f. *seppella* Fabricius), distinctly pronounced in specimens from the northern and central Apennines; fringe light golden, mostly with a slight purplish tinge; hindwing golden to bronzy golden, more or less purplish, especially at the apex; fringe light golden with a reddish tinge; legs and abdomen brown, golden shining.

♂ **Genitalia.** Uncus long and narrow, somewhat enlarged at the tip; tegumen narrow, ventrally with a long, broadly hatchet-shaped terminal appendix, weakly sclerotized especially at the anterior margin; this hatchet-shaped appendix with some short setae; accessory claspers small, slipper-shaped, inside the above mentioned appendices and ventrally beyond their beginnings; at the dorsal margin of the inner surface of the distal end of the accessory claspers four or five short, slightly bent spinoid setae, which are multiply split at their ends; mostly at the lower margin 10 long, straight spinoid setae, bent at their ends; in the middle of the accessory claspers some short setae; valvae stout, beyond the middle strongly constricted, the distal ends spoon-like and slightly bent dorsad; on their inner surface an elongated patch of setae postbasally, a row of longer setae at their distal end and two or three irregular rows of shorter, straight spinoid setae.

♀ **Genitalia.** Tergite IX missing; sternite IX only moderately sclerotized, reduced to two nearly halfmoon-shaped sclerotized plates with a narrow, weaker sclerotized junction. This sternite IX, the receptaculum seminis and also the terminal papillae are more or less characteristic for this species, although sternite IX is not so distinctive in specimens from central Italy. Terminal papillae sclerotized in a medially broader band; receptaculum seminis very long and narrow, narrowest above the middle; the last part somewhat enlarged; receptaculum seminis with a distinct striation along the whole length and a short appendix.

Diagnosis. Males with an intense, reddish colouration may be confused with *M. aureoviridella* in central Europe, but they can be separated by their lack of the golden

colouration of the inner margin and by their narrower and more silvery fasciae. Similar Mediterranean species, like *Micropterix corcyrella* Walsingham, 1919, *Micropterix erctella* Walsingham, 1919, *Micropterix italica* Heath, 1981 and *Micropterix renatae* Kurz, Kurz & Zeller, 1997, but also the alpine *M. fenestrellensis* can be recognized with certainty only by examination of the genitalia, although they are normally more reddish and show more distinct silvery whitish markings (except *M. fenestrellensis*). We also found *Micropterix myrtetella idae* Rebel, 1902 from Peloponnes with dark scales on head, which looks also very similar to *M. aruncella* f. *atricapilla*. Females can be separated from other species without wing markings by their purple colouration at the base of the forewing costa. In *M. calthella*, this colouration reaches the inner margin, whereas in *M. isobasella* and *Micropterix sicanella* Zeller, 1847 f. *obsoleta* Heath, 1963, it is almost missing. In the Alpes Maritimes we have found a form of *M. paykullella* that also lacks markings and with a less extended purple colouration of the base of the forewing. *M. mansuetella* has black scales on the head, similar to *M. aruncella* f. *atricapilla*, although the latter never has such an intense black colouration. Furthermore, these two species prefer different biotopes. *M. mansuetella* inhabits swampland, whereas *M. aruncella* is normally found on sunny, dry, nutrient-poor meadows. Nevertheless, both species can also be found more or less syntopically, where these biotopes intersect. There are further similar species in the Sierra Nevada in Spain and in northern Africa, but so far *M. aruncella* has not been found there. In all cases, males can be easily recognized by their characteristic genitalia, and also the female genitalia seem to be fairly diagnostic.

Distribution. Heath (1996) and Karsholt (2004) have reported this species throughout Europe except Portugal, Sicily, Malta, Iceland, Romania, Albania, Bulgaria, Crete and the European part of Turkey. According to Heath (1983) and Meeß (1910), *M. aruncella* is distributed throughout Europe except the Iberian Peninsula, northwards to Sweden and Finland, eastwards to Russia.

Life history. *M. aruncella* is found in meadows, in bushland, at grassy forest margins, but not inside taller forests, except within larger open clearings with grasses. This species prefers extensively used, more or less dry and bushy meadows, where the moths can be found feeding on flowering grass and also on blossoms of other plants (Heath 1960a; Meyer et. al. 2002). In the Alps *M. aruncella* occurs also in elfin woodland where we found it on flowering *Rosa pendulina* L. and *Pinus mugo mugo* Turra. In other habitats we found this species feeding on the flowers of *Crataegus* sp., *Sambucus* sp., *Urtica* sp., *Cytisus* spp., *Lychnis flos-cuculi*, *Veronica chamaedrys* and *Plantago media*. The moths are on the wing from May to August, depending on elevation. They occur from near sea level up to more than 2000 m.

Preimaginal stages. According to Heath (1962, 1983), the egg has an oval shape, a length of 400–430 μm and a width of 310–350 μm , with up to 60 μm long, rod-like structures. Immediately before hatching, the translucent white colour turns to grey. According to Klausnitzer (2002), the body length of the final larval stage is 4.0–4.5 mm. The larva was found on *Dactylis* sp., where it probably feeds on detritus (Luff 1964; Heath 1983).

The pupa rests in a robust cocoon.

Remarks. This species shows a distinctive sexual dichroism and is one of the most variable species of the genus. Besides f. *atricapilla* mentioned above, which is common in the mountainous regions of the Alps, and f. *seppella*, specimens are known from the northern and central Apennines with distinct silvery white markings on a coppery ground colour. Furthermore, from Sardinia f. *nuraghella* has been described, characterized by males without any wing markings. Nevertheless, considering the genitalia, all these forms have been proven to belong to *M. aruncella*. The forms *atricapilla* and *nuraghella*, as well as the specimens from the northern and central Apennines may therefore present distinct subspecies.

Micropterix tunbergella (Fabricius, 1787)

Tinea tunbergella (Fabricius, 1787): 253. Type locality: Denmark, Funen, Fåborg. Neotype ♂: Alléskov, Faaborg, 7.5.1926; coll. Larsen, genit. no. 842 Kristensen; in coll. ZMUC.

Tinea thunbergella auct. nec Fabricius, 1794.

Tinea helwigella Hübner, 1805: pl. 38 fig. 263. Type locality: None given. Junior subjective synonym.

Tinea rubrifasciella Haworth, 1828: 572. Type locality: Kent (Great Britain). Junior subjective synonym.

Micropteryx depictella Herrich-Schäffer, 1851: fig. 7. Type locality: None given. Junior subjective synonym.

Description of adults. Examined: 9♂, 20♀. Forewing length: ♂ 3.7–4.1 mm; ♀ 3.9–4.9 mm. Head black-brown; vestiture of hair-like scales on the head yellow, rusty yellow at the base of the antennae; antennae light brownish, 3/4 (♂), respectively 1/2 (♀) of forewing length; thorax golden; tegulae bronzy golden to purple, posteriorly purple violet; forewing with golden ground colouration and coppery to purple markings: a basal spot, extending from costa across nearly half of the forewing width; at 1/3 an elongated spot, extending from costa across 2/3 of the forewing width; distal of 1/2, a more or less broad fascia extending across the whole forewing width broadly bifurcated and purple violet at the costa, often interrupted in the middle and sometimes also bifurcated at the inner margin; at the posterior third of this fascia, mostly connected with another fascia directed to, but not always reaching the apex, narrow at the junction and spoon-like, apically broadened, sometimes bifurcated; apex and outer margin with bronzy golden to purple scales; fringe bronzy golden, golden distally; hindwing bronzy golden, often with a purple tinge apically; fringe golden, whitish outwards; legs brownish, golden shining; abdomen brownish golden.

♂ **Genitalia.** Uncus stout, in the form of a broad beak; accessory claspers well developed, with pocket-like lobes at the ventral margin, which bear many, relatively long, slightly bent spinoid setae at the anterior part of the ventral margin; a group of shorter thickened setae at the anterior tip; a bunch of long hair-like setae at the posterior part of the accessory claspers; at the anterior margin of the accessory claspers a long, lobe-like appendix on both sides extending beyond the uncus ventrally with long, hair-like setae; valvae long, very slender, upwardly bent, slightly enlarged at the tip; on the inner surface two irregular rows of shorter spinoid setae anteriorly and some setae postbasally, as well as long hair-like setae medially.

♀ **Genitalia.** Tergite IX completely atrophied, leaving only a small remnant with a patch of setae, sternite IX typically reduced, 1/3 of the width of the other sclerites in the middle, laterally enlarged into a lobe and with indistinct border. Terminal papillae typically sclerotized; ductus receptaculi enlarged at the beginning of the receptaculum seminis and strongly bent; receptaculum seminis long and narrow, somewhat enlarged in the second half, with a longer, thin appendix at the end.

Diagnosis. *M. tunbergella* can be sometimes confused with *M. mansuetella*. Also similar is *Micropterix kardamylensis* Rebel, 1903 (from Peloponnes, Greece), but it has no golden spot at the costa at 2/3 (the outer purple fascia is not bifurcated).

There is an undescribed species in Greece, which is very similar to *M. tunbergella*, but can be separated with certainty only by examination of the male genitalia.

Distribution. According to Heath (1996, 1983) and Karsholt (2004), the species is distributed across Europe. *M. tunbergella* has not been recorded from Portugal, Italy, Bulgaria and Finland.

In the Balkans, we recorded this species with certainty from Macedonia, Bosnia and Greece.

Life history (Heath 1983). *M. tunbergella* mostly inhabits deciduous woodland. The adults feed on pollen of *Quercus*, *Acer* and *Crataegus* as well as on other plants. Sometimes *M. tunbergella* has been found swarming around tree-tops.

Preimaginal stages. According to Heath (1983), the egg has an oval shape, a length of 380–390 μm and a width of 240–250 μm , with up to 100 μm long, rod-like structures. Immediately before hatching, the translucent white colour turns grey.

The larva and pupa are unknown.

Remark. The identity of the species named *tunbergella* by Fabricius in 1787 was settled by Heath et al. (1979) who designated a neotype. The name *thunbergella* (Fabricius, 1794) is a synonym of *Caloptilia alchimiella* (Scopoli, 1763) (Gracillariidae).

Micropterix aureoviridella (Höfner, 1898)

Eriocephala aureoviridella Höfner, 1898: 73. Type locality: Austrian Alps, Carinthia, Petzen near Bleiburg. 4 syntypes (2 ♂ [1 destroyed, only 1 forewing and parts of body left], 2 ♀) in coll. NHMK [examined].

Micropterix liogierella Réal, 1987: 377–378. Type locality: Cret de la Neige (France, Jura Mountains). Junior subjective synonym.

Description of adults. Examined: 10 ♂, 27 ♀. Forewing length: ♂ 3.4–3.9 mm; ♀ 3.6–4.7 mm. Head black-brown; vestiture of hair-like scales on the head rusty yellow to dirty white; antennae golden brown, purple at the base, 4/5 (♂), respectively, 4/7 (♀) of the forewing length; thorax golden, posteriorly purple violet; tegulae bronzy golden to purple violet, bluish in the posterior part; forewing bronzy golden to reddish golden, a purple violet spot near the base at the costa, basally and between the fasciae mixed with purple scales, sometimes also completely purple to purple violet in the anterior half of the forewing; inner margin broad golden to bronzy golden from the base to the middle of the wing; markings more or less silvery golden to golden, indistinctly

bordered: a fascia extending from costa across more than half of the forewing width at 1/5, sometimes poorly developed; a narrower, bent fascia across the entire width of the wing at 1/2, often narrowed in the anterior third, sometimes nearly completely interrupted; an elongated, more or less large spot at 3/4, usually not reaching the costa and the inner margin; a small bronzy golden costal spot at 3/4, sometimes very ambiguous; fringe bronzy golden to whitish bronzy golden; hindwing bronzy golden, more or less with a purple tinge; fringe lightly bronzy golden; legs and abdomen brownish, golden shining.

♂ **Genitalia.** Uncus moderately long, distinctly separated and stout; at the lower margin convex, with an area of setae; accessory claspers well developed, nearly triangular, with a row of many moderately long, partly modified spinoid setae, as well as inwardly oriented, nearly Y-shaped setae at the ventral margin of the anterior half; valvae moderately long, broad, distinctly constricted medially, strongly bent dorsad at the distal end; some setae postbasally on the inner surface of the valvae, two irregular rows of many shorter spinoid setae at the lower margin of the inner surface distally and a row of longer setae medially.

♀ **Genitalia.** Tergite IX missing; sternite IX atrophied, only 1/3 of the normal width in the middle, laterally enlarged into a weak lobe, but variably, so poorly diagnostic; distal and proximal margin distinctly bordered; lateral margin inwardly bent, indistinctly bordered. Terminal papillae with well developed sclerotized band, weakly diagnostic: proximally straight or slightly sinuate; ductus receptaculi short; receptaculum seminis small, at the beginning of the ductus receptaculi somewhat enlarged, afterwards constricted; receptaculum seminis forming a sac in proximal half, with an inconspicuous, typical striation; a thin appendix at the end.

Diagnosis. *M. aureatella* is coloured more purple violet (not as reddish as *M. aureoviridella*) without golden inner margin and with distinctly bordered, more golden fasciae. *M. aureoviridella* can be separated from *Micropterix facetella* Zeller, 1850 (from Balkans) by its lack of the small costal spot near 3/5. Sometimes *M. aureoviridella* can be mixed up with males of *M. aruncella*. Very similar are furthermore *M. aglaella* and especially *M. paykullella*, which therefore they can be identified with certainty only by examination of the genitalia.

Distribution. According to Heath (1996) and Karsholt (2004) this species has been found in Italy, Switzerland, Germany, Austria, Poland, Slovenia and Slovakia. The records from Greece (Heath 1996; Karsholt 2004) and from Romania (Karsholt 2004) seem to be doubtful.

To our present knowledge, this species occurs in the northern and southern calcareous Alps and other upland areas (Germany: Harz; Switzerland and France: Jura [*M. liogierella* Réal, 1987]). Furthermore a series of females from the Dinarian Mountains (Croatia) probably belong to *M. aureoviridella*, suggesting the occurrence of this species across the Balkans (Zeller-Lukashort, Kurz & Kurz 2002).

Life history. So far this species has been found on alkaline ground (carbonate substrate) at 900–2000 m elevation. *M. aureoviridella* prefers open and dry habitats on southwardly directed slopes, margins of light spruce forest with interspersed rocks (with ground vegetation: besides grasses, especially *Mercurialis perennis* L.), margins

of forest and scrubs in mountainous areas, as well as in elfin woodland (vegetation: *Pinus mugo* Turra, *Rhododendron hirsutum* L., *Vaccinium myrtillus* L., *Erica carnea* L., *Juniperus communis alpina* (Suter), etc.). *M. aureoviridella* has also been found in sub-alpine dwarf scrub. The adults feed on flowering shrubs including *P. mugo*. According to the elevation, the adults occur from end of May to July.

Preimaginal stages. The early stages are unknown.

Remarks. A series of females from the Dinarian Mountains (Croatia) remains of uncertain taxonomic status. Superficially they resemble *M. aureoviridella*, but their wing markings are overall dark bronzy golden and very diffuse. Their ground colouration is more reddish to purple.

M. aureoviridella has often been described as “golden green”, which is the translation of its Latin name. But the animals are mostly reddish golden and often show a more or less intense purple colouration, which is already stated in the original description by Höfner (1898).

Micropterix paykullella (Fabricius, 1794)

Alucita paykullella Fabricius, 1794: 340. Type locality: Southern Europe. Holotype ♀: in coll. ZMUC (Karsholt in litt.).

Tinea anderschella Hübner, 1813: pl. 51, fig. 352. Type locality: none given. [Synonymy suggested by Heath (1987), but not clear from Hübner's illustration].

Micropterix paykullella [sic] f. *rosarum* Müller-Rutz, 1927. 532–533. Type locality: Above Törbel, 1600 m (Valais, Switzerland). Junior subjective synonym.

Description of adults. Examined: 16 ♂, 27 ♀. Forewing length: ♂ 3.0–3.7 mm; ♀ 3.4–4.3 mm. Head black-brown; vestiture of hair-like scales on the head dirty white to rusty yellow; antennae dark brown, golden shining, 3/4 (♂), respectively, 4/7 (♀) of forewing length; thorax bronzy golden, tegulae reddish bronzy golden, partly mixed purple; inner margin of forewing broad with bronzy gold extending from the base nearly to the median fascia; a broad bronzy golden fascia nearly at 1/4, connected with the bronzy golden inner margin; the rest of the forewing reddish bronzy golden, more purple at the costa and at the apex, in some specimens completely purple to purple-violet; wing markings whitish golden to golden, delicately bordered in bronzy gold: a narrow, slightly outwardly bent fascia nearly at 1/2 across the whole width of the wing, sometimes narrowed anterior of the middle and more golden coloured; rarely a small costal spot at 3/5; a slightly ovate spot at 3/4, seldom reaching the outer margin but mostly reaching the costa, sometimes a broader, golden fascia across the entire width of the wing, whitish golden coloured in the anterior half of the wing, somewhat narrowed in the posterior third; fringe bronzy golden, somewhat purple shining, lighter distally; hindwing bronzy golden, apically with a purple tinge; fringe bronzy golden, lighter distally; legs and abdomen brown, golden shining.

♂ **Genitalia.** Uncus short, moderately broad, with a broadly rounded tip; ventrally beyond the uncus and inside the tegumen, a tuft of longer hair-like setae; accessory claspers relatively broad, rounded distally; a row of about 10 longer, straight to slightly bent spinoid setae on the inner surface of the anterior end of the accessory

claspers, which are partly hook-shaped at their ends; basally a second row of two longer, nearly straight spinoid setae and three to four sickle-shaped thickened setae; valvae moderately long, constricted beyond the middle, the last fourth enlarged, triangle-shaped and bent dorsad; a group of about five shorter spinoid setae and some setae on the inner surface postbasally; one or two rows of about 10 shorter, straight spinoid setae and a row of longer setae on the inner surface of the enlarged end of the valvae.

♀ **Genitalia.** Tergite IX missing; sternite IX reduced, weakly sclerotized, with indistinct lateral margins. The pregenital abdomen noticeably but weakly differs from other species. Terminal papillae with a sclerotized band, without any specific characteristics; ductus receptaculi very narrow at the beginning of the receptaculum seminis; receptaculum seminis relatively long and narrow, striated, somewhat enlarged in the second half.

Diagnosis. *M. paykullella* can be confused with *M. aureoviridella*, the typical form of *Micropterix sicanella* Zeller, 1847 (*M. sicanella* does not occur in the area of distribution of *M. paykullella* so far) and especially with *M. aglaella*. *M. paykullella* can be separated from *M. aureoviridella* by its broader, bronzy golden fascia at 1/4, by its mostly narrower fascia at 1/2 and by its mostly stronger purple colouration especially at the apex. It can be separated from the typical form of *M. sicanella* by its bronzy golden colouration at the costa, which does not reach the base, by its narrower fascia at 1/2 and the mostly more intense purple colouration of the forewing, but also by lacking a costal spot at 2/3. Nevertheless, both species are very variable, so they can be recognized with certainty only by examination of the genitalia. *M. aglaella* is also very similar; it shows a mostly more purple-violet colouration and sometimes a small costal spot at 2/3. The bronzy golden colouration at the base of the forewing nearly reaches the median fascia in *M. paykullella*, whereas in *M. aglaella* this colouration ends far before the median fascia. In *M. aglaella*, the outer border of the bronzy golden colouration at the base and the median fascia are nearly parallel. Since *M. paykullella* and *M. aglaella* may occur together in the western Alps, for proper identification genitalic examination is needed. All above-mentioned species can easily be distinguished by their male genitalia.

Females of *M. paykullella* can be separated genitally from *M. aureoviridella* and *M. sicanella* particularly by their distinctly slender and longer receptaculum seminis, and from *M. aglaella* by their distinctly stronger sclerotization of sternite IX and terminal papillae. Furthermore, *M. aglaella* has a slightly shorter and stouter receptaculum seminis. Females of *M. aruncella* can be easily identified by their characteristic sternite IX.

Distribution. *M. paykullella* seems to be distributed locally across the whole Alps. According to Heath (1996) and Karsholt (2004), this species occurs in France, Italy, Austria and Switzerland. Following Meeß (1910), *M. paykullella* occurs in southern France (also Viette 1948; Leraut 1980), in Switzerland (also Whitebread 1992), in Tyrol (Austria), in the Alps of Lower Austria and in Italy. Furthermore this species occurs in Vorarlberg (Austria) (Burmam & Huemer 1984) and Bavaria (Germany) (Osthelder 1951; Präse 1987).

The records from Dalmatia (Croatia/Montenegro) seem to be misidentifications probably of *Micropterix facetella* Zeller, 1851. According to Karsholt (2004) the records from Germany (Heath 1996) seem to be doubtful. Records from southern Italy and Sicily belong to *Micropterix sicanella* Zeller, 1847. In Italy, *M. paykullella* is restricted only to the Alps according to present knowledge.

Life history. Specimens without any markings were found above the timberline (2200 m) feeding on pollen of *Helianthemum* sp. Individuals with typical wing pattern were swarming around dwarf shrubs in clearings and on the outskirts of forest at lower montane level.

Preimaginal stages. The early stages are unknown.

Remarks. Individuals from the Alpes Maritimes (border between France and Italy, Marguareis, 2200 m) with golden colouration and fasciae at 1/2 and 3/4 absent or only weakly observable are confirmed genitally to belong to this species.

Micropterix allionella (Fabricius, 1794)

Tinea allionella Fabricius, 1794: 321. Type locality: Southern Europe. Type: Not designated, in coll. ZMUC (Karsholt in litt.).

Tinea tricinctella Costa, 1836: 223, pl. 2 fig. 2. Type locality: Napoli (Italy). Junior subjective synonym. *Micropteryx rothenbachii* auct. nec Frey, 1856.

Description of adults. Examined: 5♂, 3♀. Forewing length: ♂ 3.6–4.5 mm; ♀ 4.7–4.8 mm. Head black-brown; vestiture of hair-like scales on the head dirty white to rusty yellow; antennae somewhat longer than 3/4 (♂), or nearly 2/3 (♀) of the forewing length, sexually dichroic, with the ♂ brown, golden shining with more or less purple tinge, with the ♂ distinctly bi-coloured: light golden at the base to nearly 1/3, apically similar to the ♂; thorax golden, tegulae coppery bronzy golden to purple; forewing brown golden, especially at the costa mixed with purplish to purplish violet with a golden basal area and light golden to golden markings, bordered delicately in bronzy gold, broader in males, more slender in females: a broad fascia nearly at 1/4, narrowed at the costa; a broad fascia at nearly 1/2, somewhat narrower medially and more or less bent distad; mostly a small costal spot at 2/3; a fascia at 3/4, more or less triangle-shaped; wing often bronzy golden at the apex and sometimes partially so at the inner margin; tip of the apex purple; fringe whitish golden; hindwing greenish bronzy golden to bronzy golden, more or less with a purple tinge; fringe light golden, with a purple tinge at the basal half; legs and abdomen brown, golden shining.

♂ **Genitalia.** Uncus moderately long, somewhat stout, a long tuft of hair-like setae ventrally beyond the uncus; accessory claspers moderately long, about four nearly Y- or T-shaped and moderately long and thickened setae at the tip; the posterior margin of the accessory claspers slightly bent outwards (bearing some longer spinoid setae); at the lower end of the posterior margin a small separated lobe, also with one or two longer spinoid setae; another two longer spinoid setae in the middle of the accessory claspers, distinctly behind the inner margin and in line with the Y- or T-shaped thick-

ened setae; valvae moderately long, distally constricted medially, weakly bent; basally a longer spinoid seta on the inner surface as well as some setae postbasally; tip of valvae slightly spatulate with two or three irregular rows of shorter spinoid setae and a row of longer setae on the inner surface; another two shorter spinoid setae, displaced towards the constriction.

♀ **Genitalia.** Tergite IX missing; sternite IX strongly reduced, constricted medially, with a distinct border, although weakly sclerotized. Terminal papillae with a strong sclerotized band; ductus receptaculi starting broadly, then very narrow at the beginning of the receptaculum seminis; receptaculum seminis moderately long, the first third a sac that abruptly narrows; the last third an elongated sac; receptaculum seminis with distinct striation; a sac-like vestibulum.

Diagnosis. *M. allionella* can be separated from most similar species by its broad golden fasciae, its small costal spot at 2/3 and almost complete absence of a golden inner margin. Sometimes *M. trifasciella* has also a small costal spot at 2/3 and also sometimes this spot is missing in *M. allionella*, and therefore *M. allionella*, especially males with reduced golden outer margin, could be misidentified as *M. trifasciella*. *M. allionella* is also very similar to *M. rothenbachii* and cannot always be separated externally for sure. *M. rothenbachii* has a more distinct purple to purplish violet colouration, broader golden fasciae (fasciae of males of *M. allionella* are nearly as broad as the fasciae of females of *M. rothenbachii*) and a more intense bronzy golden colouration at the apex and at the outer margin. *M. allionella* without costal spot at 2/3 can also be confused with *M. aureatella* and *M. rablensis*. *Micropterix hartigi* Heath, 1981 (from southern Italy) is also usually very similar to reddish or brown-golden coloured forms of *M. allionella* (especially male), but can be distinguished by its genitalia.

M. allionella has a somewhat longer uncus than *M. rothenbachii* and also differently shaped accessory claspers. *M. allionella* has four Y- or T-shaped thickened setae at the tip of the accessory claspers (*M. rothenbachii* only three, but these are also more distinct). *M. allionella* has valvae which are only weakly bent dorsad (*M. rothenbachii* has more slender valvae and the distal third is distinctly bent dorsad). In the male genitalia, *M. trifasciella* is very similar to *M. allionella*, but can be separated as follows: The uncus is more distinctly separated and not as broad as in *M. allionella*, the accessory claspers are somewhat shorter and broader at the base. The distal third of the valvae of *M. trifasciella* is distinctly broader than in *M. allionella*, and somewhat triangle-shaped (in *M. allionella* narrow, spatulate). The differences in the genitalia to *M. trifasciella* are very small, since the kind of spinoid setae on the accessory claspers seems not to be a constant character.

The abdomen of the female of *M. allionella* is indistinguishable from *M. rothenbachii* and *M. trifasciella*.

Distribution. According to Heath (1996) and Karsholt (2004) this species occurs in France, Italy, Germany, Switzerland, Czech Republic, Slovakia, Bulgaria, Croatia, Slovenia, and Yugoslavia. Following Meeß (1910) and Meyrick (1912) *M. allionella* (noted as *M. rothenbachi(ii)*) occurs in Switzerland (see also Whitebread 1992), in northern and central Italy and in Austria. Furthermore, this species occurs in the

Bavarian Alps (Osthelder 1951; Pröse 1987), together with *M. rothenbachii* according to Pröse (1987).

Leraut (1980) has recorded this species from France, Belgium and Corsica. But these records seem partially to be misidentifications of *M. rothenbachii*. The records from Turkey (Heath 1996) seem to be doubtful.

This species has also been recorded from southern Italy (Zeller-Lukashort, Kurz & Kurz 2002; Whitebread 1995).

Life history. We found this species in clearings and on the outskirts of forest flying in tall herbaceous vegetation. The examined specimens were found at 250–1700 m elevation.

Preimaginal stages. The early stages are unknown.

Micropterix trifasciella Heath, 1965

Micropteryx trifasciella Heath, 1965: 243–245. Type locality: Italy, Piemonte, Fenestrelle. Holotype: ♂ Alpi Cozie, Val Chisone, Fenestrelle, 1300 m, leg. Della Beffa, agosto 1923 (examination of genitalia Heath No. 368); in coll. MSNM.

Micropteryx aureatella (Scopoli, 1763) *sensu* Viette 1948: 37, fig. 26. Misidentification.

Description of adults. Examined: 16♂, 13♀. Forewing length: ♂ 3.4–4.7 mm; ♀ 4.2–4.8 mm. Head black-brown, vestiture of hair-like scales on the head light to rusty yellow; antenna nearly 4/5 (♂), respectively 1/2 (♀) of forewing length, brown, golden shining with a slight purple tinge; thorax golden to bronzy golden, tegulae coppery bronzy golden to purple violet; forewing brownish golden to blue violet, at the base with little coppery to bronzy golden spots, forewing with three whitish golden to deep golden fasciae of variable width, delicately bordered with bronzy gold: a moderately broad and straight fascia at nearly 1/4, narrowing against the costa and slightly oriented distad; a moderately broad and more or less straight fascia at 1/2, sometimes bent distad; a fascia at 3/4 of variable shape, often more or less triangle-shaped, sometimes only slightly so, sometimes broadly reaching costa and inner margin; sometimes a small costal spot at 3/5; fringe purple bronzy golden, distally golden; hindwing bronzy golden, with a strong purple tinge and with bronzy golden fringe, which is purple at the base; legs and abdomen brown, golden shining.

♂ **Genitalia.** Uncus short, somewhat stout, with a moderately broad tip; ventrally beyond the uncus and inside the tegumen short tufts of hair-like setae; between the uncus and the accessory claspers an indistinctly bordered area of very long, flat setae, which are easily lost during preparation; accessory claspers short, enlarged at the tip; anterior margin slightly bent outwards, at the ventral margin a small, distinctly separated appendix; accessory claspers with 19–24 thickened setae on the inner surface: At the tip about 7–10 strongly modified, hatchet-shaped and spatulate-shaped thickened setae in an upper row, a row of very long, slightly bent spinoid setae (about 9–12, two or rarely only one of them on the aforementioned posterior appendix) on the anterior margin; three to five long, L-shaped thickened setae which extend the upper row; valvae moderately long, strongly constricted medially, the distal third spatulate or somewhat

triangle-shaped, with two or three irregular rows of shorter spinoid setae and some long setae on the inner surface; on the inner surface two or three short spinoid setae distally of the middle of the valve and one longer, straight spinoid seta basally.

♀ **Genitalia.** Tergite IX missing; sternite IX strongly reduced, constricted medially, not diagnostic. Terminal papillae with a sclerotized band; receptaculum seminis moderately long, very slender, somewhat enlarged in the second half, with typical striation.

Diagnosis. Due to the lack of the small costal spot at 2/3 this species can easily be confused with *M. hueneri* (separable with certainty only by examination of the genitalia), and also with *M. aureatella* (see Viette 1948). *M. aureatella* can be distinguished by its mostly distinctly smaller spot or fascia at 3/4 and by its mostly more slender fasciae at 1/4 and 1/2. *M. trifasciella* differs externally from *M. allionella* mostly by lack of the costal spot at 3/5. But this character is sometimes missing too in *M. allionella*, whereas it may seldom be present in *M. trifasciella*. Therefore both species can only be separated with certainty by genitalic examination. So far, they have not been found together syntopically.

There are no differences in the female genitalia between *M. trifasciella* and *M. allionella*.

Distribution. To present knowledge, *M. trifasciella* has been recorded with certainty only from the Italian and French Alps (Zeller-Lukashort, Kurz & Kurz 2002).

Life history. This species inhabits tall herbaceous vegetation around boulders between montane and sub-alpine elevations (1400–1900 m). At the type location (Fenestrelle, Piemonte, Italy) this species was found again in 2003 at the roadside, also in tall herbaceous vegetation.

Preimaginal stages. The early stages are unknown.

Remarks. Compared with the original description, the examined specimens show distinctly more slender fasciae and the shape of the fascia at 3/4 is variable.

The male genitalia figured by Viette (1948) as *M. aureatella* probably belongs to *M. trifasciella*.

Micropterix rothenbachii Frey, 1856

Micropteryx rothenbachii Frey, 1856: 52. Type locality: Switzerland. 2 syntypes in coll. BMNH.

Micropterix australis Heath, 1981a: 99. Type locality: Maroggia (Switzerland, Ticino). Junior subjective synonym.

Micropteryx rothenbachii auctt. (incorrect subsequent spelling).

Micropterix germanica Heath. Nomen nudum (see remarks).

Micropterix vallebenella Réal, 1988: 3–9. Type locality: Bonnevaux (Doubs, France). Junior subjective synonym.

Description of adults. Examined: 27♂, 12♀. Forewing length: ♂ 3.6–4.6 mm; ♀ 4.5–5.0 mm. Head dark greyish brown, vestiture of hair-like scales on the head dirty white to rusty yellow; antennae 3/4 (♂), respectively, slightly more than 1/2 (♀) of the forewing length, distinctly bi-coloured: light golden at the base (in ♀ reaching nearly to 1/3), brownish, more or less with a distinctly purple tinge apically; thorax bronzy gold-

en; tegulae coppery to purple violet, sometimes with single bluish scales posteriorly; forewing brownish golden to purple violet with whitish golden to golden markings of variable width (distinctly broader in ♂ than in ♀), delicately bordered in bronzy gold: forewing bronzy golden at the base; a fascia at 1/4, sometimes slightly broadened medially or narrowed in the upper third; a broad fascia close to 1/2, strongly bent distad and often broadened at the proximad margin; a small costal spot at 3/5; opposite, sometimes a very indistinct, very small spot at the proximad margin; a broad, triangle-shaped fascia at 3/4; this fascia sometimes enlarged along the costa towards the base and reaching the costal spot at 3/5, merging into a very large rectangular spot; this confluence often only subcostally developed, leaving at the costal margin a very small purple area; bronzy golden at the apex and at the outer margin, the bronzy golden colouration forming a slender fascia; tip of the apex coppery to purple; fringe whitish golden, bronzy to purple basally; hindwing bronzy golden with a variable purple tinge, especially at the apex; fringe bronzy golden, tips whitish; legs light bronzy golden; abdomen brownish, golden shining.

♂ *Genitalia*. Uncus short, stout, with a broadly rounded tip; ventrally beyond the uncus a brush of hair-like setae; accessory claspers broad proximally, acuminate distally, with three approximately Y-shaped, shorter thickened setae at the tip (mostly folded in permanent preparation and therefore hardly visible) and with 9–11 rigid, longer spinoid setae, sometimes slightly bent (six to eight on the apical part, two more further inside at the ventral margin, one somewhat dorsad) (see Remark); valvae distinctly bent, constricted beyond the middle, spatulate-shaped at the tip, with two irregular rows of shorter spinoid setae distal of the constriction at the ventrad margin of the mesad surface; medially and postbasally a similar seta each.

♀ *Genitalia*. Tergite IX missing; sternite IX reduced, more constricted medially than laterally, strongly sclerotized with distinct margins; lateral margins irregular, maybe diagnostic for this species. Terminal papillae with distinctly bordered sclerotized band, not protruding; ductus receptaculi at the beginning of the receptaculum seminis very narrow, before enlarging into a sac; receptaculum seminis moderately long, the first third small, then elongated into an enlarged sac; receptaculum seminis with typical striation.

Diagnosis. *M. rothenbachii* can be recognized by lack of the broad golden colouration of the inner margin. *M. allionella* is however very similar.

Distribution. Following Heath (1996) and Karsholt (2004), this species has been recorded from Italy, Sicily, Austria, Switzerland and Germany. According to Heath (1981a), this species occurs in Germany (Schwarzwald), Switzerland, Austria (Klagenfurt) and Italy (incl. Sicily). Karsholt (2004) reports this species also from Croatia and Slovenia (see also Zeller-Lukashort, Kurz & Kurz 2002).

Life history. This species inhabits light, dry and somewhat rocky, mixed beech forests, where it occurs in open places, mainly with natural cover such as brambles, grasses, etc. In central Italy, *M. rothenbachii* occurs together with *Micropterix vulturensis* Heath, 1981, and in the northern Apennines is syntopic with *M. schaefferi* and *Micropterix zangheriella* Heath, 1963.

Preimaginal stages. The early stages are unknown.

Remarks. This species was recognized as *M. australis* until 1987, whereas *M. rothenbachii* Frey, 1856 was said to be a synonym to *M. allionella*. In the original description of *M. australis*, Heath described 13 setae on the accessory clasper: "...with a marginal series of eight fairly long, stout, more or less curved setae and an inner row of five similar, straight setae."

In 1987, *M. rothenbachii* was re-established as a good species by Heath based on the examination of the type by Whitebread (1992) and *M. australis* became synonymous to it.

Originally, Heath wanted to describe a *Micropterix germanica*, but he changed the name before printing to *M. australis*, since the holotype did not come from Germany (Sattler, pers. comm.). Therefore, there are specimens in collections labelled as "*Micropterix germanica* Heath".

Micropterix huemeri Kurz, Kurz & Zeller, 2004

Micropterix huemeri Kurz, Kurz & Zeller-Lukashort, 2004: 111–114. Type locality: France, Alpes Maritimes, Marguareis. Holotype ♂: France, Dep. Alpes Maritimes, Marguareis, west slope, Navela, 2100–2200 m; 18.7.1991, GU MIC2 ♂ P. Huemer, ID-Nummer HdN-2289, in coll. TMLF.

Description of adults. Examined: 3♂, 1♀. Forewing length: ♂ 3.9 mm; ♀ 4.4 mm. Head blackish, vestiture of hair-like scales on the head yellow; antennae approximately 3/4 (♂) or almost 1/2 (♀) of forewing length, golden fuscous; thorax coppery to bronzy golden, tegulae purple violet with bronzy golden edges; forewings purple violet to bluish violet; base of costa bronzy golden; wing markings golden, delicately bronzy golden bordered; a fascia at 1/4, slightly bent, moderately broad on inner margin, distinctly narrowed from centre of wing to costa; a fascia at 1/2, slightly bent outwards, moderately broad, sometimes narrowed medially, sometimes distinctly broadened at costa; a fascia at 3/4, slightly broader than the other ones with distinctly curved inner margin; sometimes a residual costal spot at 3/5; cilia bronzy golden, apically whitish; hindwing coppery to bronzy golden, apically distinctly tinged purple; cilia bronzy golden; legs and abdomen golden fuscous.

♂ **Genitalia.** Uncus short, slightly stout with moderately broad tip; ventrally beyond uncus a tuft of hair-like setae; a small area with several faint, straight setae at the posterior margin of tegumen between uncus and accessory claspers; accessory claspers proximally broad, distally tapered, on inner surface with an upper row of six sickle-shaped thickened setae and a lower row of nine more or less straight, moderately long spinoid setae, with the two proximal spinoid setae being slightly apart; valvae slightly bent, constricted beyond middle with a triangular distal end and two or three irregular rows of shorter spinoid setae on inner surface beyond the constricted part of the valve; post-basally a distinctly robust seta on inner surface.

♀ **Genitalia and pregenital abdominal exoskeleton.** No attempt has been made to prepare the genitalia of the single available female of this species.

Diagnosis. *M. huemeri* belongs to a group of closely related species which is characterized by the following characters: The accessory claspers, seen laterally, bear two rows of thickened setae. In the ventral row, the distal thickened setae are strongly modified (Y- or T-shaped), and the one or two proximal most ones are distinctly separated from the rest of the row. These characters are shared by *M. rothenbachii*, *M. allionella* and *M. trifasciella*.

Externally, *M. huemeri* is quite well separated from the other species of this group by its three complete golden fasciae on the forewing and the absence of any further markings. One exception is *M. trifasciella*, which has very similar wing pattern elements with only slightly broader fasciae on the forewing. However, the male genitalia of *M. huemeri* differ in the shape of the accessory clasper which is conspicuously narrower proximally and has a different arrangement of the thickened setae. Furthermore, on the inner surface of the valve, the row of the short and thickened setae extends further towards the base into the constricted part of the valve.

In *M. huemeri*, the structures of the male genitalia are most similar to those of *M. rothenbachii*. *M. huemeri* can be distinguished superficially from *M. rothenbachii* by both the lack of a small costal golden spot and the golden tinge on the outer margin of the forewing. Concerning the male genitalia, *M. rothenbachii* has a distally club-shaped uncus and longer, distally more spatulate valvae with only one stout spinoid seta in the middle of the constriction.

Distribution. *M. huemeri* seems to be an endemic of the geologically isolated region of the Marguareis (France).

Life history. This species was found in high alpine grassland (at elevations higher than 2000 m) in tall herbaceous vegetation around boulders in July (P. Huemer, pers. comm.).

Preimaginal stages. The early stages are unknown.

Micropterix schaefferi Heath, 1975

Micropterix schaefferi Heath, 1975: 253–254, figs 1–2. Type locality: Austria, Upper Austria, Linz.

Holotype: ♂ Oberösterreich, Linz, 25.iv.1934, Klimesch (genitalia preparation Heath no. 213); coll. Heath, in coll. BMNH.

Micropterix anderschella (Hübner, 1813) sensu Herrich-Schäffer, 1851: 392, pl. 1 fig. 4. Misidentification.

Micropterix ammanella auctt. nec Hübner, 1813.

Description of adults. Examined: 25♂, 27♀. Forewing length: ♂ 3.8–5.1 mm; ♀ 4.7–5.8 mm. Head black, vestiture of hair-like scales on the head brownish yellow, yellow, whitish yellow or pale greyish yellow; antennae 3/4 (♂), respectively slightly more than 1/2 (♀); thorax dark golden to bronzy golden, tegulae bronzy golden, purplish to purplish violet tinged; forewings purplish bronzy golden to deep bluish violet with whitish golden to golden, finely bronzy golden bordered markings: inner margin broad bronzy golden reaching to 1/2; its basal part with an oblong spot of ground colour; apex, with exception of the outermost tip of the wing, as well as outer margin light bronzy golden; at 3/4 a small, whitish golden, often indistinct spot at the inner margin,

which is embedded in the apical golden colouration; at 1/4 a transverse fascia, narrow at costa, then broadening and reaching the bronzy golden inner margin; a broad, posteriorly somewhat narrower transverse fascia at 1/2, slightly bent outwards; a very broad transverse fascia at 3/4 reaching from costa and somewhat oblique to the centre of the wing, but not reaching the bronzy golden colouration at the outer margin; a small costal spot at 2/3, often connected with the outer transverse fascia, seldom also with the fascia at 1/2; fringe whitish golden, bronzy golden to purplish at its base; hindwing dark bronzy golden, more or less suffused with purple; fringe light bronzy golden; legs light brownish golden; abdomen brown, golden shining.

♂ **Genitalia.** Uncus more or less long, slender and somewhat flattened; accessory claspers broad, with a row of quite long, partly bent spines at the lower margin as well as with a shorter row of strongly modified, more or less Y-shaped, short thickened setae; valvae long, somewhat spatulate, narrower medially, their ends distinctly bent upwards; at the inner surface with a greater group of basal setae as well as with an irregular row of shorter spines at the lower margin and a row of long, flexible setae in the centre of the distal third of the valvae.

♀ **Genitalia.** Tergite IX missing; sternite IX much reduced, constricted in its middle, with indistinct lateral margins, similar to *M. osthelderi*; all sclerites with slightly fringe-like lateral margins. Terminal papillae with centrally somewhat enlarged band of sclerotization, whose form is not diagnostic; ductus receptaculi at the onset of the receptaculum seminis straight and very narrow for a short distance; receptaculum seminis short and a little stout, the last part an enlarged sac, with a typical transverse striation and a very narrow appendix at the end.

Diagnosis. *M. schaefferi* is easily recognized by its golden inner margin and by the costal spot at 2/3: *M. osthelderi* has a much more extensive bronzy golden colouration at the base of the forewing (including the fascia at 1/4 which is also bronzy golden and not whitish golden); *Micropterix facetella* Zeller, 1851 (from Balkans) often lacks the golden colouration at the apex and at the outer margin. *Micropterix vulturensis* Heath, 1981 and *Micropterix zangheriella* Heath, 1963, being very similar superficially, can be distinguished from *M. schaefferi* with certainty only by investigating the male genitalia. The former of these two species seems to be allopatric from *M. schaefferi*, being distributed in central and southern Italy, whereas the latter has been found sympatrically in the northern Apennines.

Concerning the male genitalia, *M. facetella* is somewhat similar, but is distinguished by its longer uncus, the more distinctly pronounced and narrower accessory claspers and by having only three basal setae at the inner surface of the valvae (*M. schaefferi* having a group of more numerous setae).

Concerning the structures of the female genitalia, *M. osthelderi* and *M. schaefferi* can be separated quite easily by the characteristics described for *M. osthelderi*.

Distribution. According to Karsholt (2004) the species is recorded from France, Corsica, Italy, Belgium, the Netherlands, Germany, Switzerland, Austria, Hungary, Czech Republic, Bulgaria and Denmark. Heath (1996) reports this species also from Poland and former Yugoslavia. Following Heath (1975) this species occurs with certainty also in Hungary and Czech Republic.

Older records concerning Asia Minor (Meeß 1910; Meyrick 1912) are very doubtfully identified.

In Italy this species seems to reach the border between the regions of Emilia Romagna and Tuscany, whereas to the South the very similar species *Micropterix vulturens* Heath, 1981 can be found.

Life history. The species inhabits open beech and coniferous mixed woodland, but also can be found in very wet situations in *Fraxinus*-dominated ravine forests as well as in dry situations in pine forests with *Erica*. Almost always the herbaceous layer in such woods is well developed, consisting in central Europe of different grasses, *Mercurialis perennis* L. and *Dentaria enneaphyllos* L., and in dry locations also *Erica carnea* L.. In elfin woodland in the mountains, the herbaceous layer is dominated by *Vaccinium* species. Furthermore, *M. schaefferi* can be found in cuttings rich in shrubs, in blackberry thickets and on sunny wood margins. The species is absent from dense woodland, especially spruce forests without herbaceous layer.

Preimaginal stages. The early stages are unknown.

Micropterix fenestrellensis Heath & Kaltenbach, 1984

Micropterix fenestrellensis Heath & Kaltenbach, 1984: 22–23, figs 3–4. Type locality: Italy, Piemonte, Val Chisone, Fenestrelle. Holotype: ♂ Alpi Cozie, Val Chisone, Fenestrelle, 1300 m, leg. Della Beffa, agosto 1923 (examination of genitalia Kaltenbach GU 204); in coll. MSNV.

Description of adults. Examined: 1 ♂, 5 ♀. Forewing length: ♂ 3.3 mm; ♀ 3.0–3.2 mm. Head black-brown, vestiture of hair-like scales on the head black; antennae dark-brown with a weak coppery tinge, about 3/4 (♂), respectively, 2/3 (♀) of forewing length; thorax anteriorly bronzy golden, posteriorly purple to purplish violet; tegulae purple-violet; forewing bronzy golden to reddish bronzy golden, purple at the base of the costa, sometimes reddish along the costa, with silvery white markings: an oval to longish, oblique spot near 1/4, not reaching costa and inner margin; a narrow fascia at 1/2, slightly bent outwards across the whole width of the wing; a round spot at 3/4 across the half width of the wing, near, but not quite reaching costa; fringe coppery bronzy golden, lighter outside; hindwing bronzy golden, with a purple tinge, especially at the apex; fringe coppery with lighter tip; legs and abdomen dark brown, golden shining.

♂ **Genitalia.** Uncus moderately long, club-shaped, rounded; tegumen and accessory claspers fused together; accessory claspers broad, trapezoid; at the anterior margin on the tip of the accessory claspers a group of short, acute, bent spinoid setae, along the anterior margin a row of five longer, acute spinoid setae, the one to two distalmost distinctly separated; at the end of this row another group of a few short, acute, bent spinoid setae; valvae moderately long, somewhat stout, constricted medially, enlarged and spatulate-like at the end; on the inner surface two longer, acute, straight spinoid setae postbasally, a very short spinoid seta medially and two or three rows of short, straight spinoid setae with some long setae at the end.

♀ **Genitalia.** Tergite IX missing; sternite IX reduced to two very characteristic, elongated sclerotized platelets, which fuse together ventrally. Terminal papillae sclero-

tized in a band, somewhat bent outwards proximally; receptaculum seminis very long and slender, the second half enlarged, with typical striation.

Diagnosis. *M. fenestrellensis* can only be confused with *M. aruncella* in its geographic range. The ground colouration of *M. aruncella* is generally less reddish, the silvery drawings are smaller and less distinct, and females do not show any markings.

The male genitalia of *M. fenestrellensis* cannot be confused with any other species, and the sternite IX of the female is very characteristic for this species.

Distribution. So far, this species has been recorded only from the type locality (Italy, Piemonte, Fenestrelle, 1300–1600 m) and from Monte Tanarello (Briga (fr.)) at 2000 m (French and Italian border area, south of Cuneo, Piemonte).

Life history. At the type locality, the species occurs together with *M. trifasciella* in tall herbaceous vegetation around bushes.

Preimaginal stages. The early stages are unknown.

Micropterix osthelderi Heath, 1975

Micropterix osthelderi Heath, 1975: 256–258., figs 5–6. Type locality: Bavaria, Fürstenrud [Fürstenried] near Munich. Holotype ♂: Bav.mer., Fürstenrud [Fürstenried] b. München, Daniel, 24.iv.26 (examination of genitalia Heath No. 261); in coll. ZSM [examined].

Description of adults. Examined: 1♂, 7♀. Forewing length: ♂ 4.7 mm; ♀ 5.0–5.6 mm. Head dark-brown; vestiture of hair-like scales on the head light to dirty yellow; antennae brownish, bronzy golden shining, 3/4 (♂), respectively, 1/2 (♀) of forewing length; thorax bronzy golden; tegulae bronzy golden, mixed with purple scales; forewing purplish violet to bluish violet: the basal fourth dark golden to bronzy golden, except small purplish violet streaks at the base of the costa and towards the dorsal margin lying within the basal bronzy golden colouration which reaches the median fascia, and a bronzy golden streak from the costa along the outer margin, just leaving the tip of the apex purplish violet; the rest of the markings whitish golden to golden, finely bordered in bronzy gold: a moderately broad fascia of equal width at 1/2, slightly bent outwards; a small costal spot at 2/3; a big costal spot at 3/4, bent inwards and sometimes enlarged towards the centre of the wing; fringe light bronzy golden; hindwing bronzy golden with a strong purple colouration, especially at the apex; fringe bronzy golden; legs and abdomen brown, bronzy golden shining.

♂ **Genitalia.** Uncus short, stout, with a small tip; accessory claspers with a lower row of shorter spinoid setae, partly bent at the end, and an upper row of strongly modified Y-shaped thickened setae; valvae long, constricted medially, with probably two longer and some shorter, basal setae at the inner surface; two irregular rows of shorter spinoid setae and a row of longer setae at the distal third of the inner surface and many small spinoid setae at the tip of the valvae.

♀ **Genitalia.** Tergite IX missing, sternite IX reduced and very similar to *M. schaefferi*, just somewhat enlarged medially. Terminal papillae with a very characteristic sclerotization: margin towards segment IX medially enlarged outwardly, with smooth margins; ductus receptaculi at the beginning of the receptaculum seminis very slender; receptaculum seminis long, constricted medially and strongly bent, only the

last part enlarged like a sac, with a typical striation; receptaculum seminis with three very small spinoid setae at the end, lying side by side (this character was found in no other species); the shape of the receptaculum seminis and the number of spinoid setae are diagnostic.

Diagnosis. *M. osthelderi* can easily be separated from all other similar species, including *M. schaefferi*, by its broad, dark golden colouration at the forewing base, and by its fascia at 1/4, which is not brightened in the middle but shows the same (bronzy) golden colouration as the inner margin. Poorly preserved specimens can easily be recognized by the very characteristic male and female genitalia.

Distribution. According to Heath (1996) and Karsholt (2004) this species occurs in Italy, Germany, Switzerland, Austria, Poland, Czech Republic and Denmark. Heath (1975) records this species from the Alps (Austria, Switzerland, Bavaria) and from the uplands (Germany: Rheingau; Poland: Sudeten).

Life history. This species seems to inhabit mixed coniferous forest especially at montane elevations.

Preimaginal stages. The early stages are unknown.

Remarks. The paratypes of *M. osthelderi* (deposited in ZSM) include also specimens of *M. schaefferi*.

Micropterix rablensis Zeller, 1868

Micropterix rablensis Zeller, 1868: 133. Type locality: Italy, Alps, south of Tarviso, Raibl. Holotype ♂: in coll. BMNH.

Description of adults. Examined: 10♂, 4♀. Forewing length: ♂ 3.0–3.4 mm; ♀ 3.25–3.8 mm. Head black-brown, vestiture of hair-like scales on the head dirty white, light yellowish grey to yellow; antennae brown, light reddish golden shining, 3/4 (♂), respectively, 2/3 (♀) of forewing length; thorax bronzy golden, tegulae bronzy golden, posteriorly coppery to purple; forewing reddish bronzy golden to purple, with three whitish golden to light golden, sometimes diffusely bordered fasciae across the whole width of the wing: a fascia at 1/4, slightly bent inwards, narrow at the costa and constantly broadening towards the inner margin; a broad, more or less straight fascia at 1/2, sometimes slightly enlarged inwards at the anterior third; sometimes a small costal spot at 2/3, which can be joined with the median fascia or with the outer fascia; a broad fascia at 3/4, often enlarged inwards in the middle; fringe coppery proximally, distally whitish golden; hindwing bronzy golden, sometimes with a slightly reddish to purple tinge; fringe slightly reddish to purple proximally, distally light golden; legs and abdomen light brown, golden shining.

♂ **Genitalia.** Uncus very short; beyond the uncus and inside the tegumen tufts of long, very acute hair-like setae; tegumen and accessory claspers fused, strongly developed; accessory claspers with a row of short, isolated, straight spinoid setae at the anterior margin, starting near the uncus; a row of short, acute, proximally straight, distally increasingly curved spinoid setae inside the lower posterior margin; anteriorly a short row of small, strongly modified, broad T-shaped (or hatched-shaped) thickened setae (starting at the anterior margin of the accessory claspers); proximally of these some

very small, acute, straight spinoid setae; valvae moderately long, slender, strongly constricted medially, the distal part spatulate, slightly bent upwards; a row of longer setae and two to three rows of short to very short, straight spinoid setae (proximally intergrading to a row of spinoid setae reaching the constriction) at the distal part on the inner surface.

♀ **Genitalia.** Tergite IX missing, sternite IX strongly reduced, weakly sclerotized in the middle distally, here partly without sclerotization (maybe characteristic for this species), partly with only indistinctly lateral margins. Terminal papillae with a sclerotized band; receptaculum seminis very short, narrow, at the beginning of the ductus receptaculi enlarged like a knot, distinctly constricted before the middle, enlarged into a sac in the last part; receptaculum seminis with striation along the entire length, but not very regular; a longer appendix at the end.

Diagnosis. *Micropterix croatica* Heath & Kaltenbach, 1984 is externally very similar to *M. rablensis*, but can be separated by its darker purple-violet ground colouration of the forewing, as well as by its more distinct, sharper markings. *M. rablensis* could be confused with small specimens of *M. aureatella* or *M. aureoviridella*. *M. aureatella* is darker purple-violet with smaller and distincter fasciae, *M. aureoviridella* shows mostly a less reddish colouration than *M. rablensis*, with indistinct markings and a bronzy golden inner margin. *M. rablensis* can be separated from both species by its broad outer fascia, which is mostly only an oval spot in *M. aureatella* and *M. aureoviridella*. Sometimes, small *M. allionella* can be confused with *M. rablensis*, which is normally smaller.

The male genitalia of *M. croatica* are very similar to those of *M. rablensis*, but can be separated besides other characters by their row of spinoid setae on the valvae, which reach the basal third. *M. myrtetella* is also related to *M. rablensis* and shows also a row of spinoid setae on the valvae postbasally, but the outer fascia of the forewing is reduced to a spot.

Distribution. *M. rablensis* is most probably restricted to Carinthia (Austria) and to the adjacent areas of Styria (Austria), of Italy (type locality) and potentially of Slovenia. According to Heath (1996) and Karsholt (2004), this species occurs in Italy and Austria.

Records from Romania (Heath 1996; Karsholt 2004) and Croatia (Karsholt 2004) are doubtful and probably belong to *M. myrtetella*. Also records from France (Viette 1948) turned out to be a misidentification (Heath in litt. according to Leraut 1980). All examined animals from Trieste (Italy) belong to *Micropterix croatica* Heath & Kaltenbach, 1984. A record of *M. rablensis* from the Traunstein (Upper Austria) in the ZOOBODAT seems to be very doubtful too. Präse (1987) probably also refers to this record. An examination of this record has not been possible so far, but probably this is a misidentification of *M. aureoviridella*.

Life history. We have found this species at outskirts of forest with tall herbaceous vegetation and bushes, congregating on *Aruncus dioicus* (Walter) and *Vicia sylvatica* L.. In competition with *M. rablensis* on flowers of *Aruncus dioicus* (Walter), we also have found *M. aruncella*, *M. aureatella* and *M. rothenbachii*.

Preimaginal stages. The early stages are unknown.

***Micropterix myrtetella* Zeller, 1850**

Micropteryx myrtetella Zeller, 1850: 62. Type locality: Italy, Tuscany, Montenero near Livorno. Holotype ♂: in coll. BMNH.

Description of adults. Examined: 25♂ (incl. slide of holotype), 11♀. Forewing length: ♂ 2.2–2.8 mm, ♀ 2.7–3.0 mm. Head black-brown, vestiture of hair-like scales on the head dark yellow; antennae brown, bronzy golden shining, more than 3/4 (♂), respectively, 2/3 (♀) of forewing length; thorax bronzy golden; tegulae purple, mixed with bronzy golden scales; forewing purple to purplish violet, distally often lighter, with golden, delicately bronzy golden bordered markings: a broad fascia at 1/4 across the whole width of the wing, narrowing towards the costa and sometimes not quite reaching it; a broad fascia nearly at 1/2, bent outwards, sometimes narrowed or even interrupted in the middle; seldom a small costal spot at 2/3; a broad, irregularly formed spot at 3/4, extending from costa across somewhat more than the middle of the wing, this spot sometimes also indistinct or nearly atrophied; fringe golden, outside whitish; hindwing bronzy golden with a purple tinge; fringe bronzy golden, distally lighter; legs and abdomen brown, golden shining.

♂ **Genitalia.** Uncus short with a broad rounded tip; ventrally beyond and inside the tegumen a tuft of hair-like setae; accessory claspers very broad; along their anterior margin on the inner surface a row of short, straight spinoid setae, slightly bent at their end; at the lower end, somewhat separated basally, a second row of five or six short, straight spinoid setae; particularly stout setae have not been found; valvae moderately long, slender, constricted medially, the distal fourth spatulate to somewhat triangle-shaped and somewhat bent upwards; postbasally a row of three or four moderately long, nearly straight spinoid setae at the inner surface of the valvae; at the inner surface of the enlarged end a row of six or seven straight, short spinoid setae and some setae.

♀ **Genitalia.** Tergite IX missing, sternite IX reduced, strongly constricted medially, not characteristic. Terminal papillae with sclerotization in an indistinct band; receptaculum seminis short and stout, the second half like a sac, with typical striation; vestibulum moderately large, simple like a sac.

Diagnosis. *M. myrtetella* is very similar to *M. rablensis* and *Micropterix croatica* Heath & Kaltenbach, 1984 (all three species are of about the same size), but can be separated most easily by its golden spot at 3/4, which spreads across the whole width of the forewing.

The male genitalia of all three species are also very similar. *M. myrtetella* can be recognized by the less stout shape of the whole genitalia and by its distinctly pronounced uncus. Furthermore, the species can be separated from *M. rablensis* by its postbasal row of spines on the valvae. Very similar is *Micropterix trinacriella* Kurz, Zeller & Kurz, 1997 from Sicily, which can be distinguished easily by its genitalia. An undescribed species from central Italy (*Micropterix wockei* sensu auctorum) can be recognized for certainty only by examination of the genitalia.

Individuals from southern and south-eastern Greece show a strong reduction of the wing markings (lacking the spot at 3/4 and the fascia in the middle), also often with

a brighter purple colouration. They are considered to be a distinct subspecies (*Micropterix myrtetella idae* Rebel, 1902).

Distribution. According to Heath (1996) and Karsholt (2004) this species occurs in Italy, Austria, Hungary, Croatia, Macedonia, Yugoslavia, Romania, Bulgaria, Albania and Greece (see also Heath 1965b).

Some of these records may refer to *M. rablensis* or *Micropterix croatica* Heath & Kaltenbach, 1984. The records from Slovakia and Czech Republic (Karsholt 2004) seem to be doubtful.

The male specimen found in Austria (Gumpoldskirchen) has been verified by genitalic examination. Further confirmed records are from the type location in Italy, Croatia, Montenegro and Greece (NW-Greece, Pilion, Peloponnes).

Life history. This species inhabits outskirts of medium canopy height to tall, dense mediterranean woody shrubland. Also at the type locality (Italy, near Livorno, Montenegro) we found a female flying in Mediterranean maquis shrubland.

Preimaginal stages. The early stages are unknown.

Remarks. The holotype shows a small, but distinct costal spot at 2/3, a character missing in most other specimens, especially those from the Balkans.

A male of *Micropterix myrtetella idae* Rebel, 1902 from Peloponnes with dark scales on head (very similar to *M. aruncella*) also belongs to this species as recognized by its genitalia.



Figs 39–42. Typical habitats of some *Micropterix* species. **39.** Slope of moor with *Alnus* sp. association (*M. mansuetella*). **40.** Nutrient-poor meadow with grass, *Galium* sp., *Rumex* sp., and shrubs along the side of a path at the fringe of a spruce forest in the montane zone (*M. aruncella*). **41.** Edge of a spruce forest with areas of *Vaccinium* sp. and *Frangula alnus* in the lowlands (*M. aureatella*) **42.** Moist meadow with *Ranunculus* sp. and shrubs at the fringe of a lowland coppice forest (*M. calthella*).



Figs 43–46. *Micropterix* adults in their natural habitat. **43.** *M. mansuetella*. Specimen resting on *Alnus* sp.: Austria, Eastern Tyrol, Lienzer Dolomiten, Lavant, Kienbichl, June 10, 2004. **44.** *M. aruncella*. Specimen feeding on *Plantago media*. Austria, Vorarlberg, Bregenzer Wald, near Bezau, Sienspitze, upper Hintereg-Alpe. **45.** *M. aureoviridella*. Specimen feeding on *Pinus mugo*. Austria, Vorarlberg, Rätikon, Lünensee, near Douglashütte, 2000 m, July 30, 2004. **46.** *M. calthella* (♀, ♂). In copula. Austria, Salzburg, Flachgau, Köstendorf, Tannberg, from the summit to the Lassbergweg, May 15, 2005.



Figs 47–54. Forewings golden without any or with small silvery markings (first ♂, second ♀). **47–48.** *Micropterix calthella*. **49–50.** *M. isobasella*. **51–52.** *M. paykullella*, unicolourous form with strongly reduced markings, see also Figs 65–66. **53–54.** *M. aruncella*, typical form, see also Figs 55–56.



Figs 55–62. Forewings golden with silvery or coppery to purple markings (first ♂, second ♀). 55–56. *Micropterix aruncella* f. *atricapilla*, see also Figs 53–54. 57–58. *M. fenestrellensis*. 59–60. *M. mansuetella*. 61–62. *M. tunbergella*.



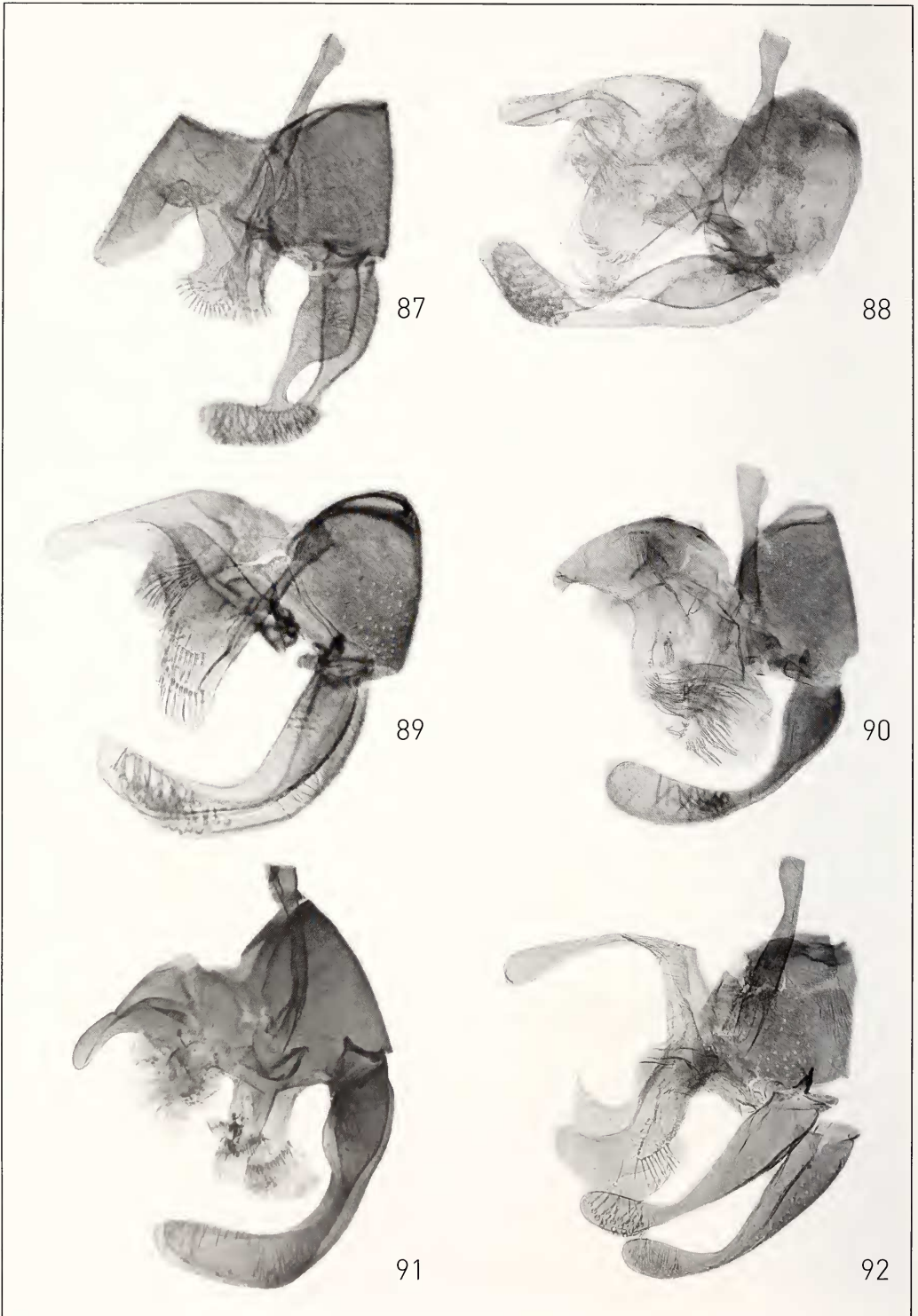
Figs 63–70. Forewings reddish golden to purple violet, with 2 golden fasciae and a spot at 3/4 (first ♂, second ♀). 63–64. *Micropterix aureoviridella*. 65–66. *M. paykullella*, typical form, see also Figs 51–52. 67–68. *M. aglaella*. 69–70. *M. aureatella*.



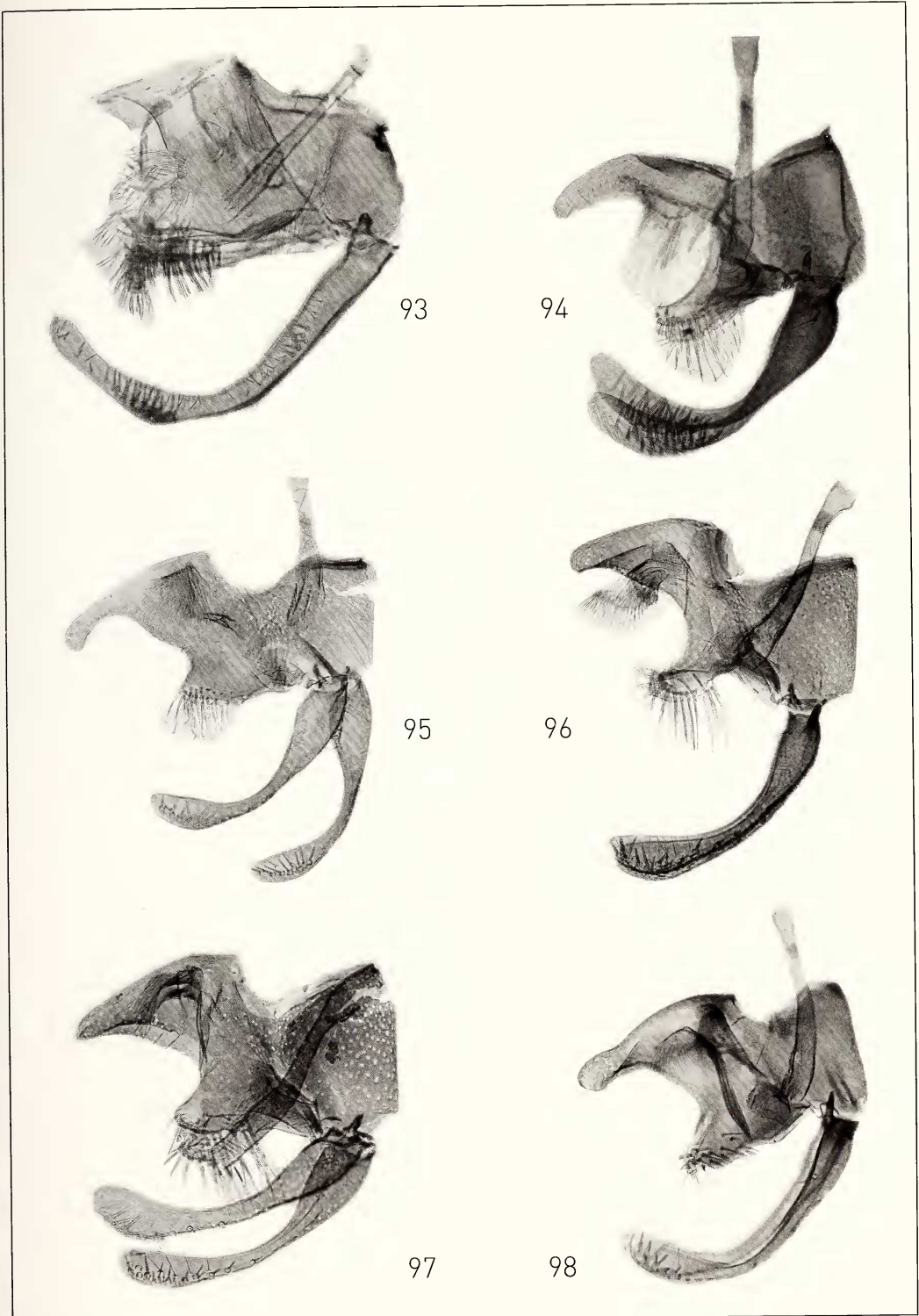
Figs 71–78. Forewings brownish golden to blue-violet with 3 fasciae (first ♂, second ♀). 71–72. *Micropterix rablensis*, ♂ with aberration on forewing. 73–74. *M. myrtetella*. 75–76. *M. trifasciella*, ♀ with aberration on forewing. 77–78. *M. hueneri*, not mounted.



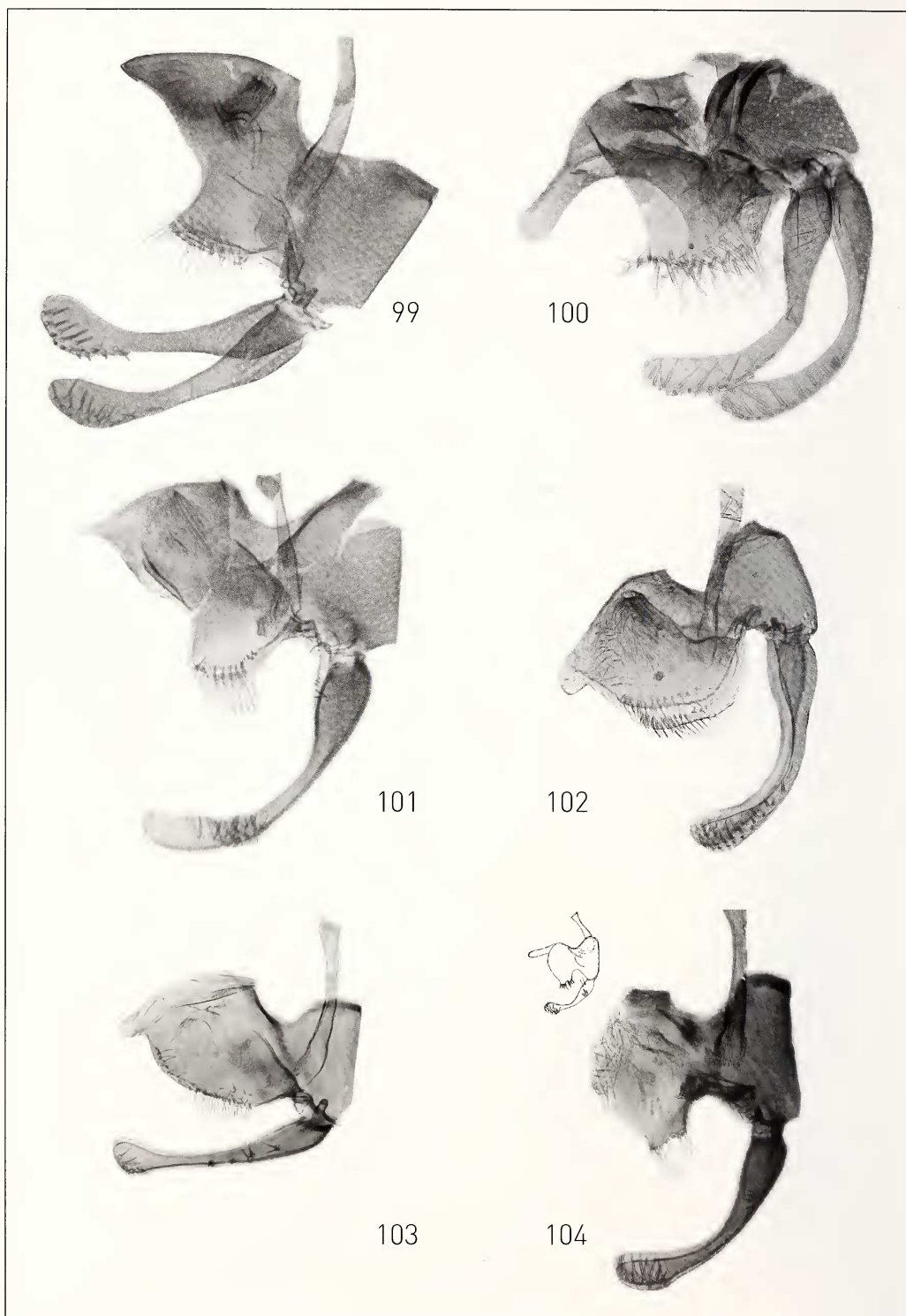
Figs 79–86. Forewings with additional golden drawings at the outer and/or at the inner margin (first ♂, second ♀). 79–80. *Micropterix allionella*. 81–82. *M. rothenbachii*. 83–84. *M. schaefferi*. 85–86. *M. osthelderi*.



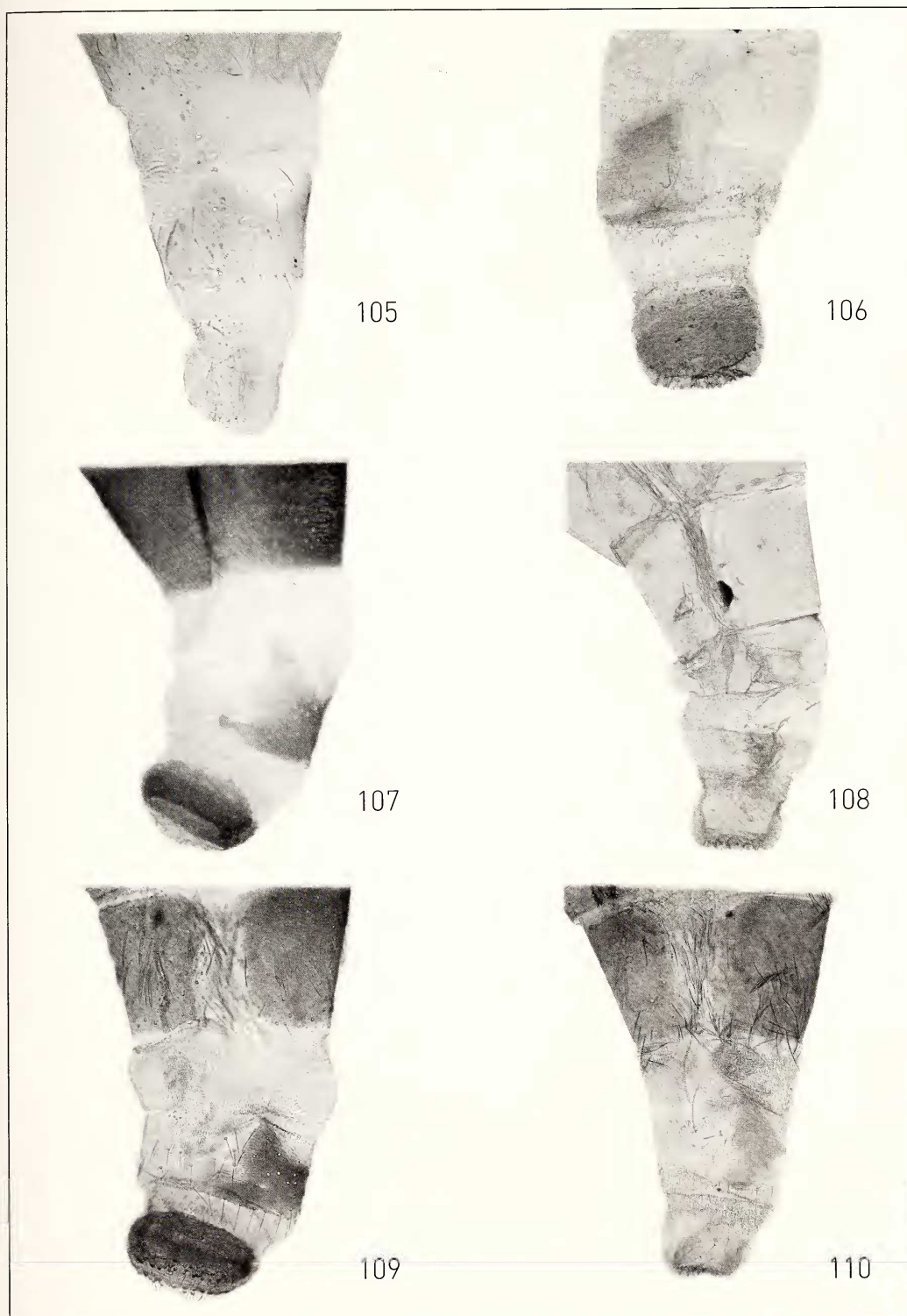
Figs 87–92. ♂ genitalia. 87. *Micropterix mansuetella*. 88. *M. calthella*. 89. *M. isobasella*. 90. *M. aglaella*. 91. *M. aureatella*. 92. *M. aruncella*.



Figs 93–98. ♂ genitalia. 93. *M. tunbergella*. 94. *M. aureoviridella*. 95. *M. paykullella*. 96. *M. allionella*. 97. *M. trifasciella*. 98. *M. rothenbachii*.



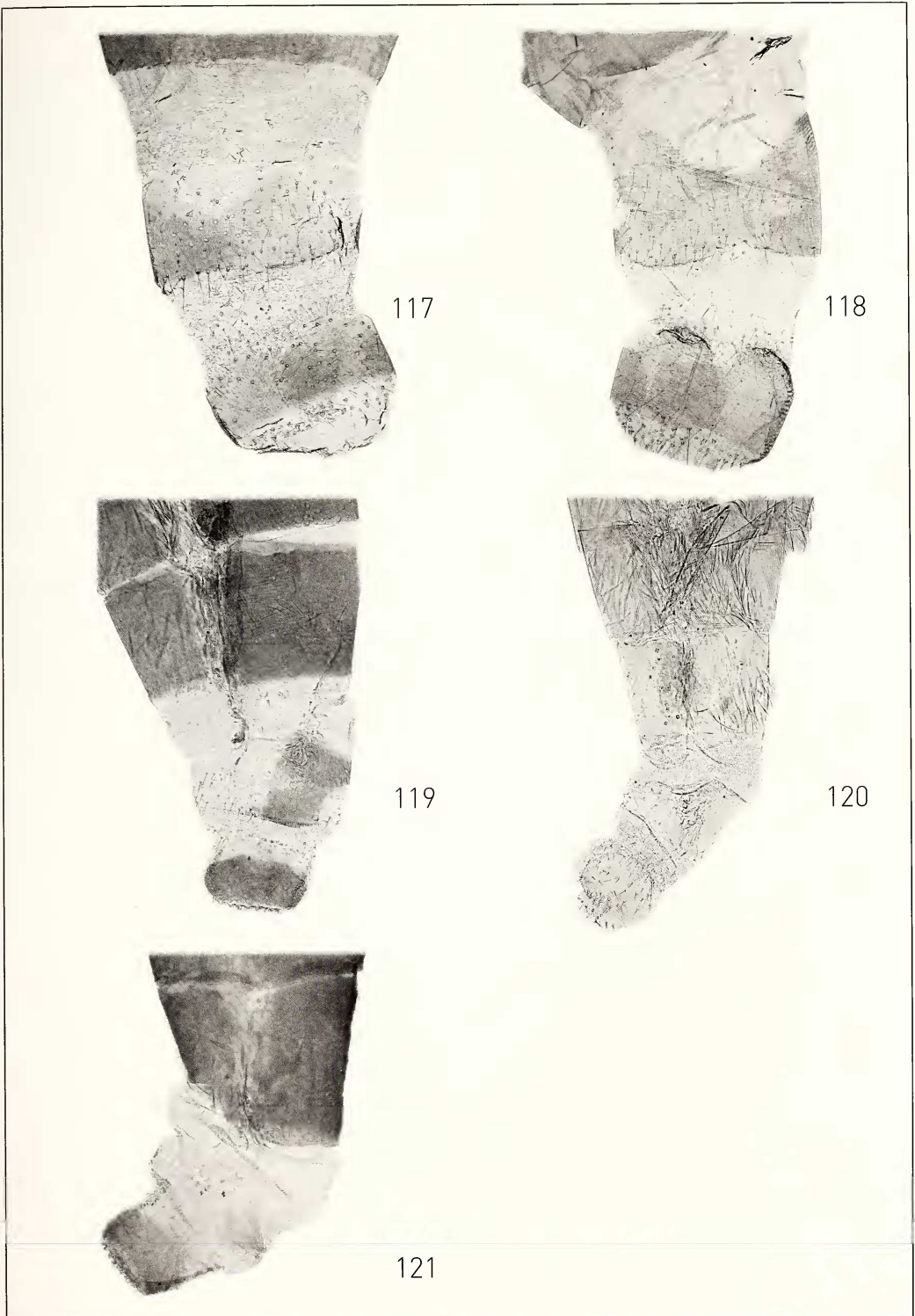
Figs 99–104. ♂ genitalia. 99. *M. huemeri*. 100. *M. schaefferi*. 101. *M. osthelderi*. 102. *M. rablensis*. 103. *M. myrtetella*. 104. *M. fenestrellensis* (uncus destroyed, see Fig. 20).



Figs 105–110. ♀ abdomen. **105.** *Micropterix mansuetella*. **106.** *M. calthella*. **107.** *M. isobasella*. **108.** *M. aglaella*. **109.** *M. aureatella*. **110.** *M. aruncella*.



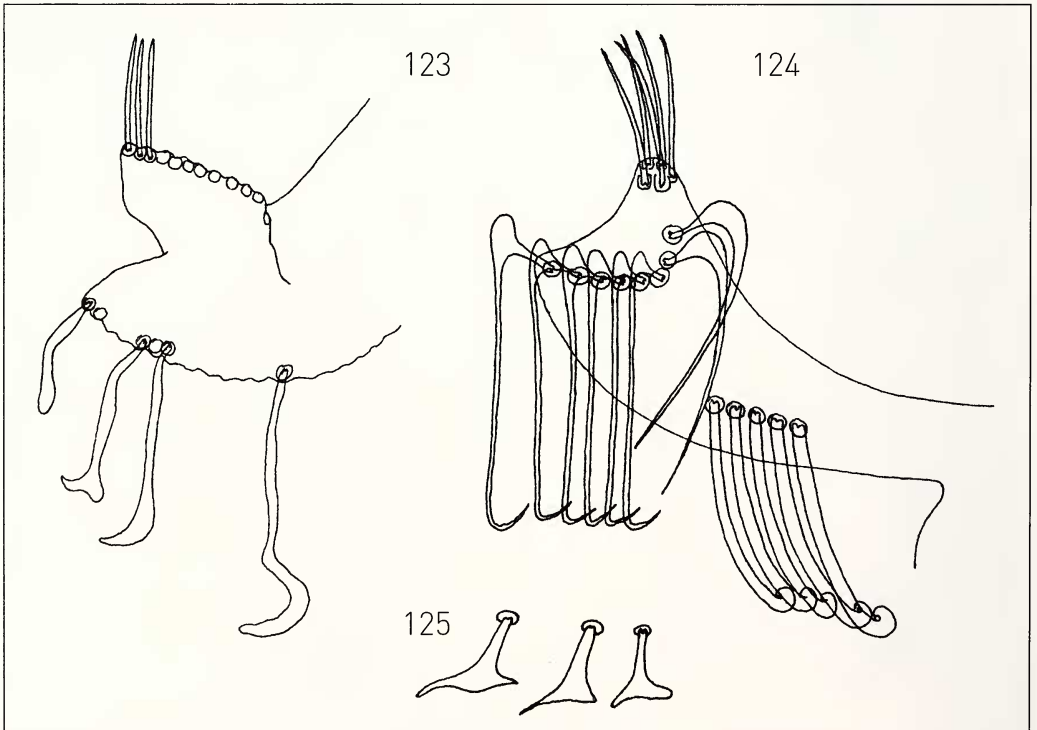
Figs 111–116. ♀ abdomen. **111.** *M. tunbergella*. **112.** *M. aureoviridella*. **113.** *M. paykullella*. **114.** *M. al-ionella*. **115.** *M. trifasciella*. **116.** *M. rothenbachii*.



Figs 117–121. ♀ abdomen. 117. *M. schaefferi*. 118. *M. osthelderi*. 119. *M. rablensis*. 120. *M. myrtetella*. 121. *M. fenestrellensis*.



Fig. 122. Geographical area considered for this work.



Figs 123–125. Different forms of thickened setae on the accessory claspers. 123. *M. aureatella*. 124. *M. sicanella* (distinctly three groups of setae) 125. *M. schaefferi*, T- or Y-shaped.

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